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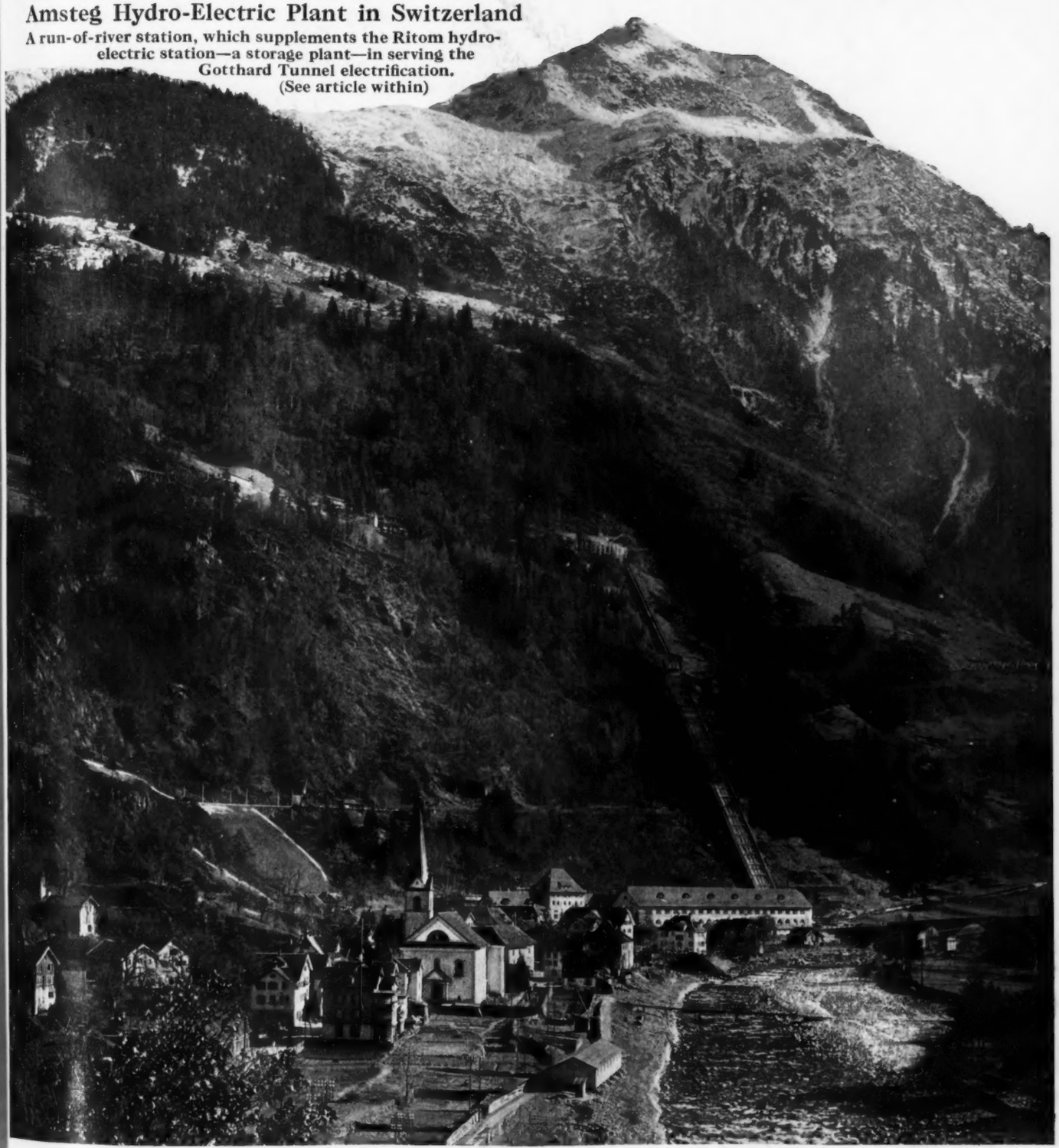
Electrical World

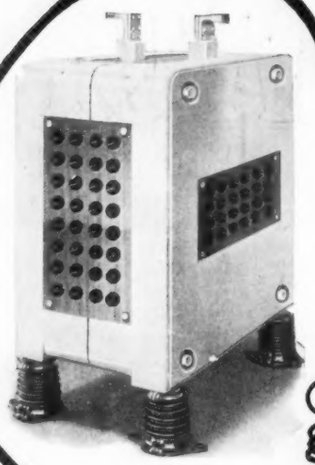
Amsteg Hydro-Electric Plant in Switzerland

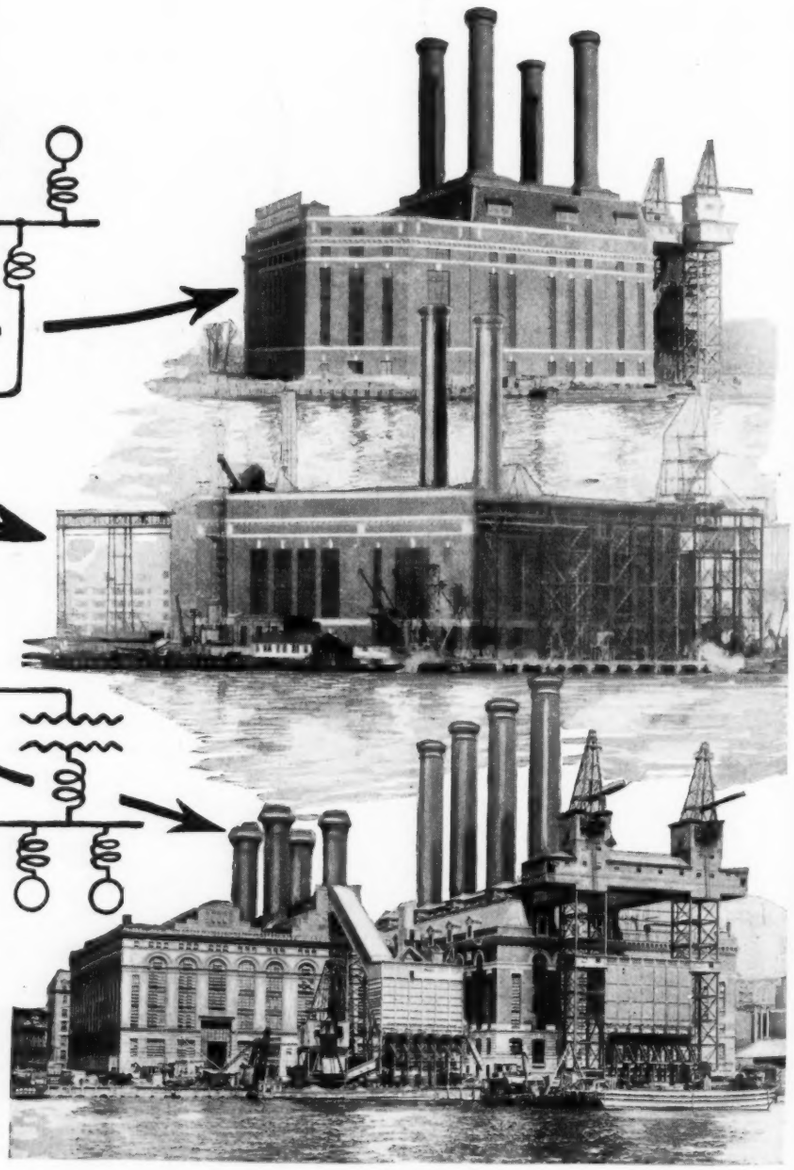
A run-of-river station, which supplements the Ritom hydro-electric station—a storage plant—in serving the Gotthard Tunnel electrification.
(See article within)



An Interview with Harris J. Ryan,
President of American Institute of Electrical Engineers

Why do the World's Greatest Power Plants Use Metropolitan Reactors?





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W. H. ONKEN, JR. Editor

HAROLD V. BOZELL Editor

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Warren G. Harding

A WAVE of sadness has swept over the nation on account of the death of President Harding. We mourn his loss as an executive and as a man and confidently await the verdict of history on his presidential achievements. The great harmonizer came into office in troubled times, when men and nations were bitter and despondent and rent with contending interests. President Harding courageously fought to bring worldwide harmony and friendship out of this chaos. In domestic affairs he created a new common-sense business and professional atmosphere in national administration practices which has already made possible real accomplishment in stabilizing a nation badly shaken by internal and external dissension.

Kindly, courteously and calmly he gave his ear, his thought and his time to all who sought his counsel, and he sacrificed his life in service to his country and in an attempt to bring relief and succor to a sorely disorganized world.

Not a genius, not an outstanding warrior or statesman, conservative and sane rather than spectacular, he represented the best type of American—the type that serves for the good of the nation with modesty, industry, kindliness and a recognition of the value of human relations.

The electrical industry joins the nation in its tribute to the departed who served so wisely, so sincerely and so well.

Sydney Richard Inch

An exceptionally capable central-station executive and a well-trained engineer who has grown up with hydro-electric development in the West.

SYDNEY R. INCH, vice-president and general manager of the Utah Power & Light Company, is a well-trained engineer, a hard worker of great aggressiveness, and possesses a remarkable ability, founded on natural executive capacity plus engineering training, to grasp quickly any situation that may arise.

Mr. Inch was born in Taunton, England, in 1879, where he received his general education, after which he went to London for his technical training at Finsbury Technical College. Before coming to the United States in 1900, at the age of twenty-two, he had gained practical experience in English central-station work at Taunton and in the manufacture of storage batteries with the Lithonode Electric Storage Company of London. Upon his arrival in America he was employed by the Montana Power Transmission Company, one of the predecessors of the present Montana Power Company, and became an operator at the first hydro-electric power plant furnishing power to Butte, Mont. In this way Mr. Inch became identified with one of the earliest hydro-electric power developments in the Intermountain region. After working his way up through various positions with the Montana Power Transmission Company and the Butte Electric & Power Company, another predecessor of the Montana Power Company, he went to Missoula, Mont., where he became the manager of a group of public utilities owned by the late Senator W. A. Clark.

In 1912 Mr. Inch became general superintendent of the Utah Power & Light Company, with headquarters in Salt Lake City. In 1915 he was made operating manager of the company and in 1918 became its vice-president and general manager. He is also vice-president of the Utah Light & Traction Company and the Western Colorado Power & Light Company, both of which are subsidiaries of the Utah Power & Light Company. The former company operates the street-railway system in Salt Lake City, and the latter furnishes light and power service to a considerable portion of southwestern Colorado. These allied companies form one of the largest public utility systems in the West. Under the able management of Mr. Inch they have been a constructive force in the upbuilding of the Intermountain territory in which they operate.

Editorial Comment

Electrical World, August 11, 1923

Volume 82 Number 6

Vice-President in Charge of Sales and Public Relations

TO VITALIZE the sales efforts of a central-station company, to give impetus to public relations work and to tie these two things together in a manner at once effective and sufficiently dignified to insure respect from the public is a move as important as any that the company can make. In these columns a few weeks ago it was suggested that a "vice-president in charge of sales"—to include also public relations work—is one effective way to indicate publicly, as well as within the company, that these activities are, as they deserve to be, on an equal plane with engineering and finance.

Comments received from many central-station executives on this expression of opinion give evidence that there is wide approval of the idea, though only in scattered places has it been put into practice. But elsewhere in this issue the Pacific Gas & Electric Company's plan of organization of such a combined department headed by a vice-president is related. Two vice-presidents have headed the sales and public relations departments—there has been sufficient dignity for them, it seems. But, following the death of one of the industry's grand old men—John A. Britton—one of these vice-presidents, F. A. Leach, was made general manager, succeeding Mr. Britton. The company then made an excellent move—recognizing the growing interdependence of commercial activity and public relations work—by combining the two departments under one vice-president, R. E. Fisher, "in charge of sales and public relations." Mr. Fisher's plan of organization will surely be of interest to all central-station executives. Naturally, any plan is good only so far as it provides a program for men to follow. On the other hand, men trying to work without a plan are likely to end nowhere. The accomplishments of the newly created combined department will be watched with interest.

Adequate Meter Testing Essential, but Not Necessarily Expensive

NO REASONABLE operating company would expect meters to be shipped thousands of miles, handled four or five times, and yet be accurate on either a 25-watt or a 1,000-watt load, and run on as little power as is used by a flashlight. It would seem, however, that some operating companies are not reasonable, judging from the number that install meters without a pre-service test after receiving them from the manufacturer. Of course, small plants cannot keep a man busy testing meters, but every plant can have a carefully handled test meter and can afford the time necessary to check and inspect each meter in the shop or soon after is is installed and to give periodical tests thereafter. The right way is to put meter work in the hands of a man with technical knowledge, but in small stations where this may now be impossible a meterman can at least follow the instructions issued by manufacturers. It is possible to train any one who is willing to study a little to become a good routine meter test man. With a knowledge of meter testing and meter connections as a basis, a young man who wants to learn will find many interesting problems which will gradually lead him on to further study of electrical engineering.

It cannot be too often repeated that the meter department should have proper facilities for doing its work. Too many metermen have only a bench in some dark corner of the plant, where all kinds of junk accumulate. The surroundings always have an influence on the kind of work a man does, and a wise company will locate and equip its meter department with this in view.

Relative Merits of Different-Type Waterwheels

ONE of the notable advances of the past decade has been the evolution of the hydraulic turbine to a point which not many years ago seemed a sheer impossibility. From time to time there have been gains in efficiency and particularly the attainment of high capacity and speed of rotation without sacrificing other qualities. For some time there has been a notable drift of practice toward the use of reaction turbines at very high heads in lieu of the ordinary impulse wheel, which with all its virtues of simplicity and endurance has never reached the pitch of efficiency touched by the turbine. More recently installations have been made of combined impulse reaction turbines which open another epoch in hydro-electric power development.

With three types of waterwheels now available for use instead of only the two which formerly divided the field of application rather definitely and without question, the situation as to where each type is most effective and desirable becomes more confusing. No longer is there a definite line of demarcation between the respective fields, but each type is to a considerable extent invading the field of the adjacent one. A decision on a type for a given installation is not so easy, and it appears that it would facilitate the proper application of the various types of waterwheels if manufacturers would unite in compiling data that will give prospective users a yardstick for comparison. In addition the prospective user wants to know how the different types of units stand up in service. This information can be obtained if there is a free, frank exchange of experience on how well efficiency is maintained over a period of time, how subject each type of wheel is to erosion, how accessible the parts are to repair, and so forth.

To be more specific, the following information should be tabulated: Permissible ranges of speed for different types of waterwheels at different heads and ratings, the probable efficiencies under these conditions at half, three-quarter and full rating and 25 per cent overload;

relative cost of wheels for different conditions, amount of auxiliary equipment required for each type, comparative foundation costs for each type, relative size of wheels of each type for different conditions, relative maintenance expenses for each type, ease of inspection, and simplicity of construction and control. These are merely suggestions. Perhaps other factors are more important in a relative comparison, but information on only the subjects named would be more helpful than the meager data now available.

Pole Specifications Will Be Governed by the Available Supply of Poles

JUST what the available pole supplies are and how they can be used to the best advantage are questions to which the American Engineering Standards Committee cannot fail to give a great deal of attention in its forthcoming work on wooden-pole specifications. In working out these specifications it must be remembered that the committee is dealing with a product manufactured by nature. It is therefore specifying the best use of what is available and not the quality of a product subject to control in manufacturing processes.

Three principal woods are commonly considered for use. The chestnut is the best known in the Eastern market, where it is most largely produced. The chestnut blight, which has created so much havoc in the last eight or ten years, is commonly supposed to mean an early end to the supply. Actually there is a considerable quantity of chestnut poles dribbling into the market, which raises a question whether the supply is as nearly exhausted as has been thought. The next source is the Northern and Western cedar. It is commonly thought to be the largest available supply in the country, though Northern white cedar in the longer lengths is hard to get. The third supply is the treated Southern yellow pine. Among the woods used locally in various parts of the country because they are handy and cheap are the fir and tamarack of the Pacific Northwest, the juniper, and to some extent the cypress of the South. These four varieties, like the Southern yellow pine, are all short-lived when untreated, and there are few data available to show just what effect on their usefulness treatment might have.

The available supplies of all kinds of woods which can be used ought to be the first matter investigated as it will be impossible for the sectional committee to handle the specification problem intelligently until the real supply is known. As an example of what must be considered, the practice in producing Western cedar poles seems to be that of cleaning up each timber tract as the production crews reach the tracts. The wood is a slow grower and will not replace itself in a reasonable length of time. The method of production yields a large number of short poles that can be sold only to small telephone companies or worked into fence posts or possibly pulp wood. This supply introduces a real production and cost problem into the cedar-pole industry. The Southern yellow pine—or, rather, the various woods so classed—is a rapid grower. Some producers of these poles say that they can go to a tract, take what they want and in a few years repeat the process. Such a situation may have a decided bearing on specifications that the Standards Committee will ultimately recommend, and the facts on available supply and reproduction possibilities on all kinds of usable timber ought all to be in hand before the committee work proceeds too far. Undoubtedly most of the data are available from timber resource reports and need only to be put together in usable form.

Electric Melting of Brass Deserves Wider Adoption

UNDER the stimulus exerted by the Great War, the electric melting of brass, both in large and in small quantities, has been brought to a high degree of efficiency. Yet thousands of small fuel-heated brass foundries are still operating throughout this country. To convert them to modern methods will necessitate much missionary and educational work on the part of power-sales solicitors, but the results will be well worth the effort.

The advantages of electric melting of brass, as outlined in a recently issued statement by the United States Bureau of Mines, should be of considerable assistance to the advocates of "doing it electrically"—this statement coming as it does from a competent and impartial organization.

With proper safeguards, no hesitancy need be felt regarding the desirability of the load; moreover, it is not objectionable from the point of view of other consumers of electrical energy.

A Story of Local Trade Relations

HERE is an incident that points the finger at a situation that demands and certainly deserves some serious thought on the part of central-station chief executives:

One of the editors of the ELECTRICAL WORLD not long ago talked for an hour or so one afternoon with a prominent electrical contractor in a Middle Western city. This young man had inherited a business—a struggling, debt-weighted contracting business which included a fixture department and an appliance store—and without experience and against heavy handicaps had built it up in a short time into a prosperous enterprise.

In doing this he naturally established himself in a position of some prominence in the electrical circles of his city. He had became one of the three largest contractors in town. He was doing a large fixture business. But his appliance store had not kept pace. "The central station," he said, "is selling on such terms that it amounts to unfair competition and there is no use trying to push appliances on such a basis."

"How long since you have talked to the general manager of the lighting company about this?" he was asked.

"Why, I have never talked to him about it," was the answer.

"Well, how long since you have seen him?"

"As a matter of fact I have never met him."

The situation was sufficiently interesting to follow up. The editor dropped in upon the G. M. of the power company, the local chief executive, whom he had long known. "How much do you know about this fellow Blank, the contractor?" he asked.

"Well, really," said the G. M., "I don't know very much about him at all. I understand he does good work and is making money."

He listened to the story of what this local man had achieved. He was intensely interested—enthusiastic.

"By George," he said, "I'll go and see that fellow. He's done a great job."

"How long since you've been in his store?" came the question.

"Well, do you know," he said, "I'm ashamed to say it, but I never have been in it."

And when he heard why this contractor had been afraid to expand his appliance department he was surprised. "Why, I'll go around to see him right away," he said, "and straighten all that out. I'll carry his easy-payment account for him if he wants me to."

The time this contractor needed the guidance and backing of the central station most was in the early period of struggle. He might have gone to the G. M. and told him so. But a man hates to call for help. If the utility man had felt his full responsibility, however, he himself would have called upon the other in the beginning, offered to help, learned his problem, stiffened his back with a show of friendly interest, and the appliance store would have grown and prospered also, to the material benefit of the utility.

This general manager is an enlightened executive, interested and successful in public relations. But he had overlooked the fact that the local electrical trade relations are one of the prime influences in building popularity and good will. Friendly, prosperous contractors are an invaluable asset to the utility.

Worth-While Methods in Transmission-Line Design

OBSERVATIONS over a large part of the country indicate that rule-of-thumb methods in transmission-line design are more widely used than engineering knowledge of the subject justifies. While careful attention has come to be given to the determination of sizes of conductors and to the design of steel towers, the location of structures is still very largely a matter of guesswork even on lines with steel supports. And yet, on this one operation more than on any other perhaps depend the stability of a line, its operating life and its maintenance expense. By careful attention to location it is possible to avoid or at least mitigate the unbalanced strains that lower stability, decrease life and increase maintenance cost.

Elsewhere in this issue is outlined a happy compromise between rule-of-thumb and academic methods that was followed by the Kansas Gas & Electric Company in the construction of a 132-kv. double-circuit steel-tower line. The template method which was used in structure location is not new, but comparatively few engineers seem to be familiar with it. Intelligently used, it means that the structures can be placed where there will be a minimum strain upon them. The use of the cold template insures against "uplift" on structures in cold weather due to locations too low or improperly selected. The most important requirement in using the hot and cold templates is an accurately determined profile.

The attention given angles on the Kansas line calls attention to another element in transmission-line design that too often receives insufficient consideration. Angles cannot be totally eliminated, but they can be reduced in value and the unbalanced strains incident to angle construction lessened. This reduction can be made to mean longer structure life and smaller maintenance costs. It means also that less expensive structures can be used at angle points. In steel-tower construction this has a big significance in dollars and cents.

Although the Kansas story is based on steel-tower lines, the design methods used are equally applicable to wooden-pole construction and will yield the same advantages there in cost, life and line maintenance expense.

Cable Charge and Discharge

PROBLEMS of insulation are very much to the fore these days. More than ever it is being realized that insulation is the limiting element in all high-voltage equipment, and that in spite of years of experiment and development and of new and improved insulating materials, little is known as to the laws governing the performance of these materials.

Within the last year or two several notable contributions to our knowledge of the nature of dielectric breakdown have appeared. The National Research Council is actively supporting a committee on insulation, recently described in these columns, and the program of the recent annual convention of the A. I. E. E. contained several notable papers in this field. Of these, that by Dr. Steinmetz on cable charge and discharge deals with the subject of dielectric absorption, one of the most obscure, least known, and perhaps the most important of all insulation phenomena, certainly as regards high-voltage cables and machinery. It causes the time lag in the soaking in of charge under continuous voltage.

The initial values of absorption current are very large, and these large values persist over intervals of time quite large compared with the period of a commercial alternating cycle. Consequently Dr. Steinmetz's conclusion that the power component of the charging current of a cable under alternating voltage is equal to the initial value of the absorption current makes a direct appeal to common sense. This paper is an excellent example of its author's remarkable facility in presenting obscure electrical phenomena in terms of quantities and method of analysis which may be readily understood by the engineer. Starting with the assumption that a dielectric is made up of a very high resistance in series with a capacity, an assumption which has often been made, the analytical development is carried much further and reaches the conclusion that the charge and discharge curves have one principal exponential term, accompanied by one or more additional terms of relatively much smaller magnitudes.

The conclusions coincide admirably with observations on cables in operation. Dr. Steinmetz's analysis will go far toward helping the active engineer to form a mental picture, in terms of every-day quantities, of what is going on in a dielectric. It must be remembered, however, that these every-day quantities are not actually present in dielectrics, and the picture that he draws will scarcely be sufficient to guide us in our efforts to improve and control insulation through a better knowledge of its nature. This can only come by separate study of the various components entering commercial insulation and of their behavior in combination, with the aid of the rapidly expanding field of electrophysics and the light that it is throwing on the structure of the atom and the nature of electric conduction and dielectric displacement.

From Addresses by

Calvin Coolidge

INDUSTRY, thrift, character are not conferred by act or resolve. Government cannot relieve from toil. It can provide no substitute for the rewards of service.

* *

Ultimately, property rights and personal rights are the same thing.

* *

We have reached the age of invention, of commerce, of great industrial enterprise. It is often referred to as selfish and materialistic. Our economic system has been attacked from above and from below. But the short answer lies in the teachings of history. The hope of a Watt or an Edison lay in the men who chipped flint to perfection. . . . The hope of tomorrow lies in the development of the instruments of today. The prospect of advance lies in maintaining those conditions which have stimulated invention and industry and commerce. The only road to a more progressive age lies in perfecting the instrumentalities of this age.

* *

Where commerce has flourished there civilization has increased. It is only when the exchange of products begins that development follows.

* *

It is only a figure of poetry that "wealth accumulates and men decay." Where wealth has accumulated, there the arts and sciences have flourished, there education has been diffused, and of contemplation liberty has been born.

* *

Let us dismiss the general indictment that has all too long hung over business enterprise. While we continue to condemn, unsparingly, selfishness and greed and all trafficking in the natural rights of man, let us not forget to respect thrift and industry and enterprise. Let us look to the service rather than to the reward. Then shall we see in our industrial army, from the most exalted captain to the humblest soldier in the ranks, a purpose worthy to minister to the highest needs of man and to fulfill the hope of a fairer day.

* *

We have had many attempts at regulation of industrial activity by law. Some of it has proceeded on the theory that if those who enjoyed material prosperity used it for wrong purposes, such prosperity should be limited or abolished. That is as sound as it would be to abolish writing to prevent forgery.

* *

There is just one condition on which men can secure employment and a living, nourishing, profitable wage for whatever they contribute to the enterprise, be it labor or capital, and that condition is that someone make a profit by it. That is the sound basis for the distribution of wealth and the only one. It cannot be done by law, it cannot be done by public ownership, it cannot be done by socialism. When you deny the right to a profit you deny the right of a reward to thrift and industry.

* *

The discontent in modern industry is the result of a too narrow outlook. A more liberal culture will reveal the importance and nobility of the work of the world, whether in war or peace.

* *

Taxes must be measured by the ability to meet them out of surplus income. Industry must expand or fail. It must show a surplus after all payments of wages, taxes and returns to investors. Conscription can call once, then all is over.

* *

. . . The day when it is the duty of all Americans to work will remain forever. . . . It is not money that the nation or the world needs today, but the products of labor.

Design Methods Used in Building a Kansas Transmission System

Plan Followed in Erection of Towers on 132-Kv. Line of the Kansas Gas & Electric Company—Description of Types of Towers Used—Design of Angle Construction

TO GET away from the use of small generating stations and obtain the best results in the operation of its property, the Kansas Gas & Electric Company has constructed a steel-tower transmission line connecting the two portions of its system. It runs between the Midian substation just east of El Dorado in the westerly group to a point near Neosha in the easterly group, where a new steam-electric generating plant is being constructed. This will give the system two large and efficient steam plants, the other being the one at Wichita now in operation. The groups are interconnected with transmission lines, largely of 60-kv. rating, though some lower voltages are still in use.

Some of the design and construction methods used in the installation of this steel-tower line, which will operate at 132 kv., 60-cycle, three-phase, will be described in this article.

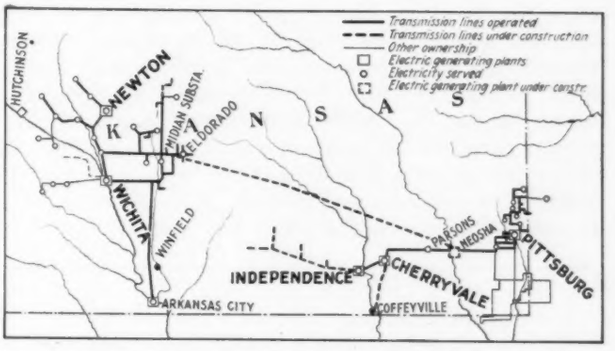


FIG. 1—TWO PORTIONS OF KANSAS GAS & ELECTRIC COMPANY'S SYSTEM TIED TOGETHER BY 132,000-VOLT LINE

CONSIDERATIONS INVOLVED IN DESIGN

The first consideration in the design of this line was to ascertain the shortest feasible route. Every mile of line that can be eliminated means so much less labor and material in original construction and a proportionately less expense in maintenance, operation and line losses. The preliminary location was picked by airplane, the reconnaissance being carried out in one day by E. C. Curtis, the chief engineer for the company. It was found

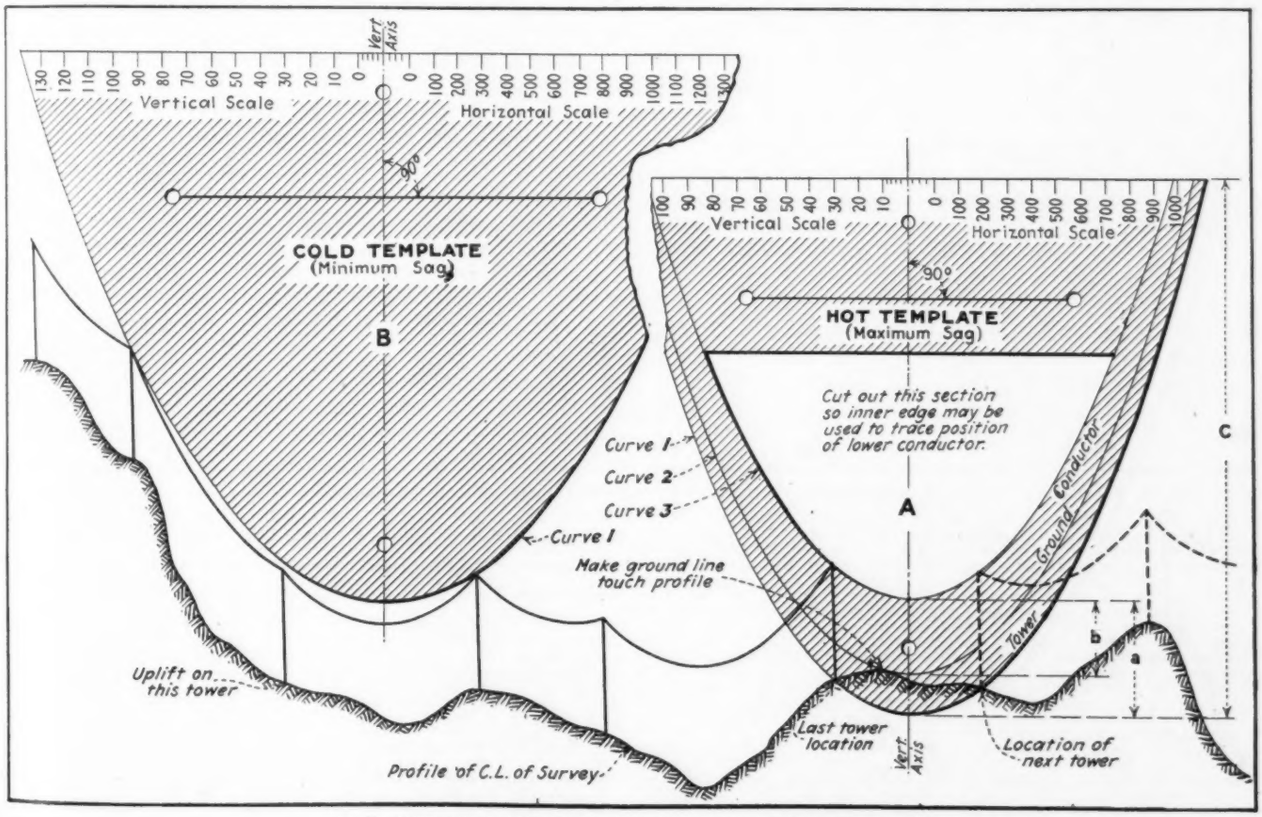


FIG. 2—HOT AND COLD SAG TEMPLATES AND METHOD OF USING

Dimension *a* is the height above ground of the point of conductor support. Dimension *b* is the minimum clearance of the lowest line conductor from the surface of the ground. Dimension *c* can be made to suit the user. Both templates are made of clear, double-thick celluloid. The "hot" template is used to locate the structures on the profile drawing. The "cold" template is used to check the location of structures under low-temperature condition. This method of using them is indicated.

that flying at a height of approximately 1,000 ft. would allow the observer to gain a clear idea of the country, which is generally flat, for a distance of approximately 2½ miles on either side of the line of flight, or a strip 5 miles wide. With maps of the territory available and arranged for quick taking of notes, a strip of 5 miles was reconnoitered on the trip from the flying field at Wichita to the eastern end of the line and another strip of 5 miles on the return trip. This was done in one day. If the reconnaissance had been carried out in the ordinary way, at least ten days to two weeks would have been required to accomplish the same results. It was possible for the observer to make sufficient notes on the character of the country to allow the selection of an approximate route so that surveys could be arranged for. The line was finally located as shown in Fig. 1. While it is impossible on so small a map to show the angles in 110 miles of line, the illustration gives a fair idea of the location, the angles being slight and the whole line being as straight as possible. The greatest angle is less than 20 deg.

The second consideration was the location of structures so that they would be subjected to the least possible strain under the climatic conditions that they must withstand. To this end the elimination of angles was sought so far as it was practicable. Where it was impossible to eliminate an angle steps were taken to reduce it to a minimum. Careful attention was given to the location of towers to avoid unbalanced strains or to reduce them, where they could not be eliminated, to the least possible amount of unbalance. The method employed in the location of these structures was as follows:

A survey was made which included a transit line, a level line and the side slopes on the upper side of the line at points where the slope was sufficient to cut down the ground clearance of the outside conductors to too low a value. This survey also included all the property lines of land crossed, ties to bench marks and obstructions such as existing utility lines, railways, buildings and other things that must be considered in laying out and securing the right-of-way for the line.

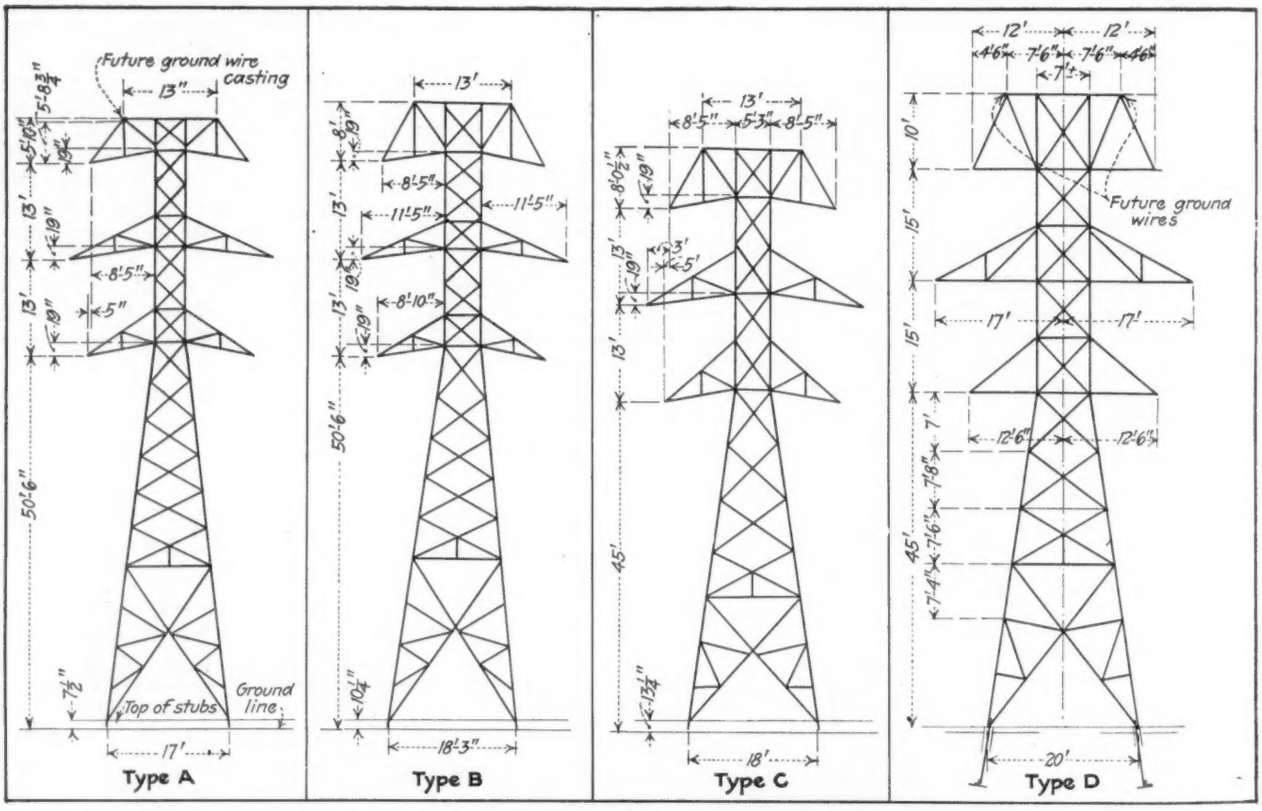


FIG. 3—FOUR TYPES OF TOWERS AND PRINCIPAL DIMENSIONS

Type A is used for tangent construction only. A normal span of 850 ft. is employed on this line. The assumed conditions of loading for design purposes include a range of temperature from 20 deg. below zero to 120 deg. above zero. F. and an ice load of ½ in. with 8 lb. wind pressure. The type A tower specifications call for test loads as follows: A horizontal, longitudinal or transverse pull of 15,000 lb. applied at the elevation of the middle cross-arm; two horizontal longitudinal pulls of 4,000 lb. each applied simultaneously and in either direction at any two insulator supports, or one pull of 6,000 lb. applied at either ground cable support, or one pull of 4,500 lb. applied at any one cross-arm; three vertical loads applied simultaneously, two of 3,500 lb. at each of any two insulator supports, and one of 4,500 lb. at either ground-wire cable support.

Type B tower is used on small angles, the maximum being 8 deg. and for a maximum span of 1,400 ft. where longer than normal line spans are used. The test loads on this tower are: A horizontal, longitudinal or transverse pull of 30,000 lb. applied at the elevation of the middle cross-arm; three horizontal, longitudinal pulls of 5,100 lb. each applied simultaneously and in either direction at any three insulator supports, or two pulls of 7,300 lb. applied at the ground wire supports, or one pull of 7,500 lb. applied at any one cross-arm; four vertical loads applied simultaneously, three of 7,000 lb. at each of any three insulator supports and one of 7,000 lb. applied at either ground wire-cable support.

When the transposition cross-arm is used on this tower in place of the standard middle cross-arm the horizontal pulls must be reduced to 3,000 lb. and the vertical loads to 4,500 lb.

Type C tower is used for intermediate angles not over 45 deg. The test loads consist of a horizontal longitudinal or transverse pull of 60,000 lb. at the elevation of the middle cross-arm, two horizontal pulls of 12,500 lb. each applied simultaneously and in either direction at any two insulator supports, or two similar pulls of 15,000 lb. each applied at the ground cable supports and three vertical loads applied simultaneously, of 15,000 lb. at each of any three insulator supports, and 15,000 lb. at either ground-wire support.

Type D tower is the heaviest and is used for dead-ends and would have been used for angles greater than 45 deg. had there been any. The test loads are: One horizontal, longitudinal or transverse pull of 110,000 lb. applied at the center of the gravity of the insulator supports; three horizontal, longitudinal pulls of 15,000 lb. each applied at any three insulator supports in either direction, or two similar loads of 15,000 lb. each applied at the ground-wire supports; eight vertical loads of 15,000 lb. each applied simultaneously at the six conductor and two ground-wire supports.

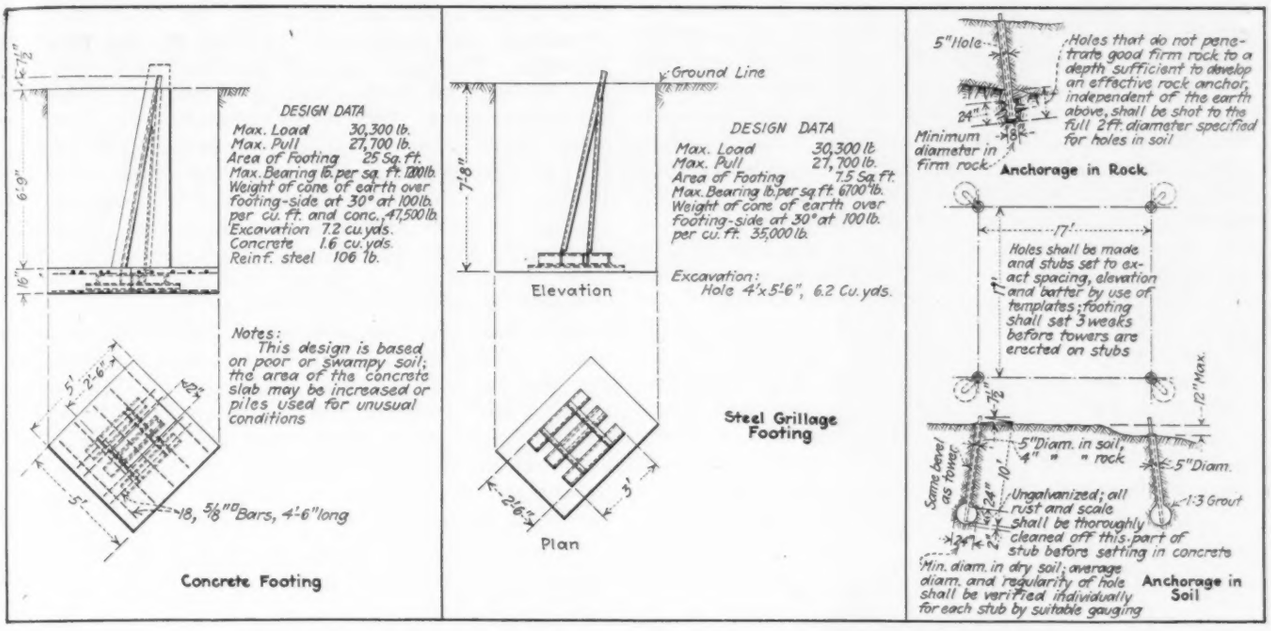

DESIGN DATA
Max. Load 30,300 lb.
Max. Pull 27,700 lb.
Area of Footing 25 Sq. ft.
Max. Bearing lb. per sq. ft. 1200 lb.
Weight of cone of earth over footing-side at 30° at 100 lb. per cu. ft. and conc. 47,500 lb.
Excavation 7.2 cu. yds.
Concrete 1.6 cu. yds.
Reinf. steel 106 lb.
Notes:
This design is based on poor or swampy soil; the area of the concrete slab may be increased or piles used for unusual conditions
18, 5/8" □ Bars, 4'-6" long
Concrete Footing
Ground Line
Elevation
DESIGN DATA
Max. Load 30,300 lb.
Max. Pull 27,700 lb.
Area of Footing 7.5 Sq. ft.
Max. Bearing lb. per sq. ft. 6700 lb.
Weight of cone of earth over footing-side at 30° at 100 lb. per cu. ft. 35,000 lb.
Excavation:
Hole 4'x5'-6", 6.2 Cu. yds.
Steel Grillage Footing
Plan
5" Hole
Holes that do not penetrate good firm rock to a depth sufficient to develop an effective rock anchor, independent of the earth above, shall be shot to the full 2 ft. diameter specified for holes in soil
Minimum diameter in firm rock
Anchorage in Rock
Holes shall be made and stubs set to exact spacing, elevation and batter by use of templates; footing shall set 3 weeks before towers are erected on stubs
5" Diam. in soil, 4" " " rock
5" Diam.
Same level as tower
Ungalvanized; all rust and scale shall be thoroughly cleaned off this part of stub before setting in concrete
1:3 Grout
Min. diam. in dry soil; average diam. and regularity of hole shall be verified individually for each stub by suitable gauging
Anchorage in Soil

FIG. 4—GRILLAGE AND CONCRETE TOWER FOOTINGS AND METHODS OF ANCHORAGE
The footings are for Type A towers only. Those for other towers are heavier.

All these data were plotted to a horizontal scale of 400 ft. to the inch and a vertical scale of 40 ft. to the inch.

This arrangement of scales permitted reproducing nearly 2 miles of line on a sheet 20 in. x 26 in. in size, which is about as large as can be handled conveniently in construction work, either office or field. For the actual layout of tower locations a template* like that shown in Fig. 2 was used. Both hot and cold sag curves are illustrated with their method of use.

SAGS MUST BE CONSIDERED

In passing it should be noted that stadia methods of taking levels will not do in this class of work, particularly when changes in ground levels are pronounced. Structures are located with the template as shown. One pole on a side slope has been so located that under low-temperature conditions the sag of the conductor will naturally come above the top of the pole and serious uplift strains will be incurred. Two remedies are available, to move the structure until it meets the curve or to increase the height of the structure. Which method will be adopted in any case depends on the conditions to be met. In general it is desirable both from the standpoint of expense and good operation to avoid the use of higher structures. It is well to note that this method of locating transmission line structures is just as useful with wooden as with steel structures and that the same care in locating and protecting wooden structures from unnecessary strains is necessary.

Four types of towers are used on the line. The general design is shown in an accompanying illustration. All are designed to carry six 266,800-circ.-mil steel-core aluminum conductors having a maximum tension of 6,470 lb., and two $\frac{3}{8}$-in. stranded high-strength galvanized-steel ground conductors. The latter have not been installed, though provision is made for them if they are needed in the future.

*See article by J. S. Viche, ELECTRICAL WORLD, June 15, 1911, page 1556.

The unit stresses used in the design of the towers are: Tension, 30,000 lb. per square inch; compression, $30{,}000 - 100\,l/r$; bolt shear, 25,000 lb. per square inch; bearing, 50,000 lb. per square inch.

The type A and B towers support the upper end of the lower insulator strings at a height of 50 ft. 6 in. above the ground, while the type C and D towers support these insulators at 45 ft. above the ground line. The clearance of the conductors from the towers with an insulator string 5 ft. 6 in. in length and a conductor swing of 45 deg. is 4 ft. and at 60 deg. is not less than 3 ft. 6 in. The type of tower footings used on the majority of the towers is shown in one of the accompanying illustrations. Both concrete and grillage are provided for use as conditions make essential. Concrete footings were, of course, used on the heavily loaded type C and D towers in all places. Another type of footing, known as the Malone footing, was used on the east end of the line. This was described in the ELECTRICAL WORLD for March 3, 1923, page 524. One footing is shown which is formed by first boring a hole 4 in. or 5 in. in diameter to the required depth and then exploding a charge of dynamite at the bottom of the hole to form the chamber into which concrete is poured after the stub is set in place. The advantages of this form of anchorage are a reduction in cost and the small disturbance caused in the fields in which the towers are set. This is particularly important when fields are already planted or crops growing.

INSULATOR ASSEMBLIES

Four types of insulator assembly are used. The straight suspension string is of course most extensively employed. It has ten 10-in. disk units. The dead-end assembly is made up of two strings of eleven units in parallel to gain mechanical strength. The semi-tension assembly is used at crossings over railways and other points where dead-end insulators might otherwise be required. This assembly has all the advantage of a dead-end assembly, though it is subjected normally to the same strains as the suspension

assembly. When broken conductors or the release of strain on the conductors on one side of the assembly occurs, it will swing into a tension position and take tension strains until the line is restored to normal. Another type of assembly is used to replace the semi-tension insulator. It is a suspension assembly with two strings in parallel and equipped with dead-end clamps. The assembly normally hangs as a suspension assembly, but in case of accident to the line causing a broken conductor or the release of strain on one side, it swings to a tension position and becomes a tension insulator until the line is restored to normal. The advantage of this assembly over the semi-tension is ease of adjustment in tying in the conductors. The semi-tension assembly is difficult to adjust at this time, while the double suspension assembly may be tied in as easily as the ordinary suspension. The advantage of either of these assemblies over tension insulators is that they are not constantly under heavy strain. This is an advantage both in the maintenance of insulators and the line structures.

ANGLE CONSTRUCTION

Although angles are expensive and an undesirable form of construction, they cannot be avoided, and the best that can be done is to exercise extreme care in line location to make them as small as possible. When this has been done the selection of towers for such angles as remain must be made. In the case under notice the accompanying chart was used. It was made up to fit the conditions imposed by the use of the three aluminum conductors and two steel ground wires on this line. The upper part of the chart shows the data and method used in the checking of insulator swings on the angle towers. This detail is important as a lack of attention to it may result in too small a clearance from the supporting structure and subsequent operating troubles due to flashovers to the tower, or it may require the use of more expensive structures than should be necessary. With the ordinary attachment of the insulator to the structure there would be cases in which it would be necessary to adopt rather expensive measures to keep this clearance when other conditions require nothing in the way of structure adjustments. For this reason an extension bracket is used with the suspension assembly on the type B towers. This merely brings the insulator farther out from the tower, and as shown in the shaded area at the left side of the lower half of the chart an insulator swing of 8 deg. maximum on the type B tower can be used as against a maximum of about 1 deg. on the type A tower. The jumper ofttimes becomes a problem on some of the angles, and to keep it rigid and prevent swinging into the tower an angle iron jumper guide is employed where necessary.

The lower half of the chart shows the angle and span limit for each of the four types of towers. It will be noted that this is given in terms of average spans and horizontal angles. The meaning of the term "span" as used is shown at the upper right-hand corner.

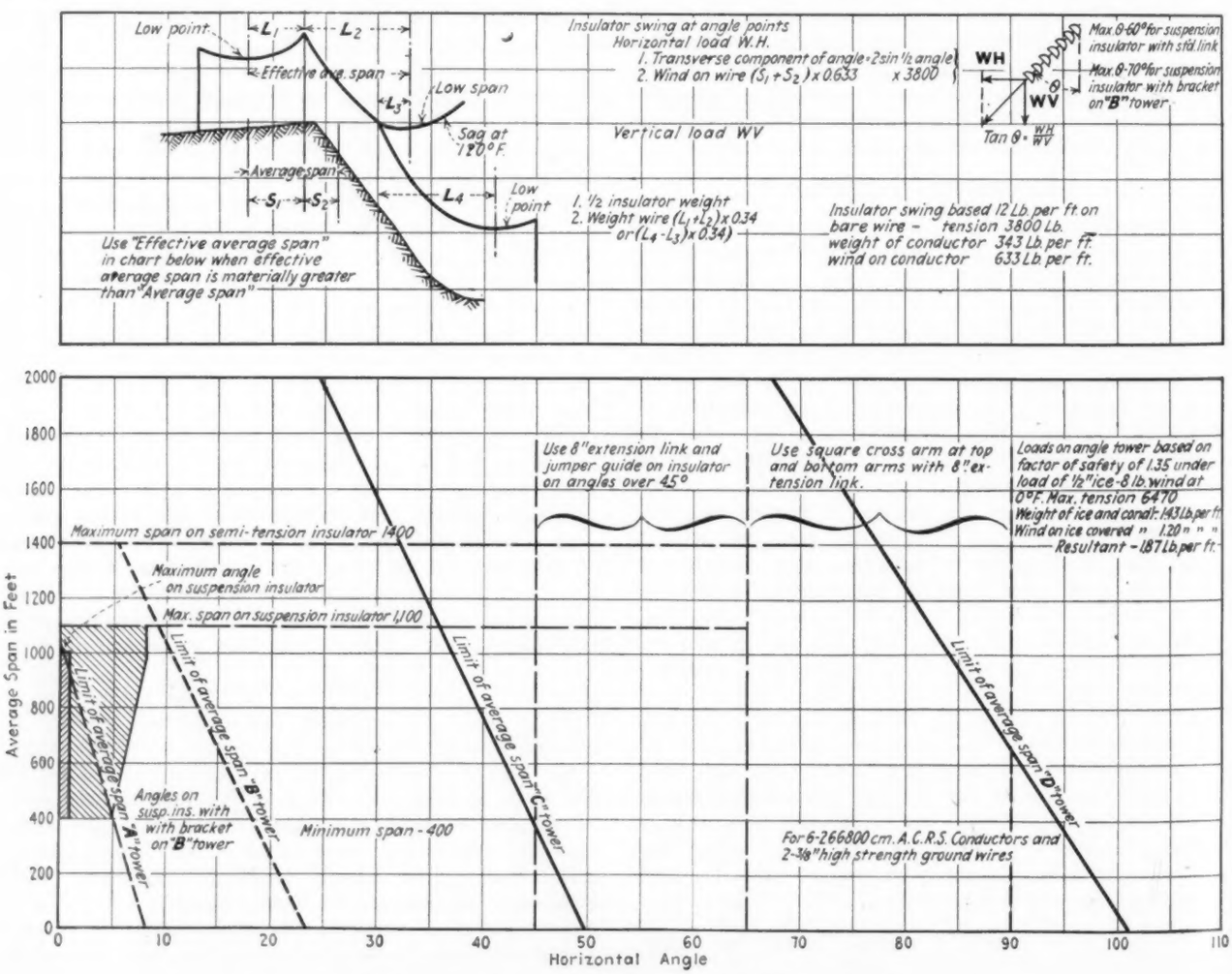

Low point
L_1
L_2
Effective ave. span
Low span
L_3
Sag at 120° F.
Average span
S_1
S_2
L_4
Low point
Use "Effective average span" in chart below when effective average span is materially greater than "Average span"
Insulator swing at angle points
Horizontal load W.H.
1. Transverse component of angle = 2 sin ½ angle
2. Wind on wire $(S_1+S_2) \times 0.633 \times 3800$
Vertical load WV
1. ½ insulator weight
2. Weight wire $(L_1+L_2) \times 0.34$ or $(L_4-L_3) \times 0.34$
WH
WV
θ
Tan θ = WH/WV
Max. θ 60° for suspension insulator with std. link
Max. θ 70° for suspension insulator with bracket on "B" tower
Insulator swing based 12 Lb. per ft on bare wire – tension 3800 Lb.
weight of conductor 343 Lb. per ft.
wind on conductor 633 Lb. per ft.
Use 8" extension link and jumper guide on insulator on angles over 45°
Use square cross arm at top and bottom arms with 8" extension link.
Loads on angle tower based on factor of safety of 1.35 under load of ½" ice-8 lb. wind at 0° F. Max. tension 6470
Weight of ice and condr. 1.43 Lb. per ft.
Wind on ice covered " 1.20 " " "
Resultant – 1.87 Lb. per ft.
Maximum span on semi-tension insulator 1400
Maximum angle on suspension insulator
Max. span on suspension insulator 1,100
Limit of average span "A" tower
Limit of average span "B" tower
Limit of average span "C" tower
Limit of average span "D" tower
Angles on susp. ins. with with bracket on "B" tower
Minimum span - 400
For 6-266800 cm. A.C.R.S. Conductors and 2-3/8" high strength ground wires
Average Span in Feet
Horizontal Angle
0
200
400
600
800
1000
1200
1400
1600
1800
2000
10
20
30
40
50
60
70
80
90
100
110

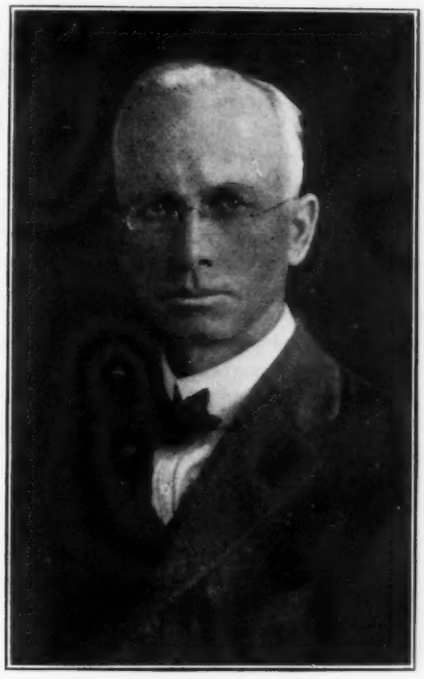
FIG. 5—CHART USED TO DETERMINE ANGLE CONSTRUCTION

President of A. I. E. E. Says Engineers Should

Make Facts Public

Engineers Should Shoulder Civic Responsibilities
Research Should Be Encouraged
Technical Standards Should Be Maintained

By **L. W. W. Morrow**
Associate Editor "Electrical World"



Harris J. Ryan
President A.I.E.E.

"ELECTRICAL methods are as necessary to our civilization as the nervous system is to the human body, and electrical engineers must shoulder greater and greater civic responsibilities for the benefit of the nation," said Harris J. Ryan, the new president of the American Institute of Electrical Engineers, in response to a query regarding the duty of engineers to participate more actively in national affairs. "The truth always overcomes the false, according to the records of history, and this is a significant and reassuring fact in my opinion, for it at last inexorably corrects the world's blunders and determines the world's ideals. But truth usually conquers only through fighting, and the engineers can expedite the victory because they are armed with the requisite skill and knowledge to deal with modern conditions.

"The truth about engineering matters affecting the national welfare must be disseminated to the public by engineers. There is a real obligation resting upon them to present engineering and economic facts, and they must abandon their inherent dislike of publicity and publicity methods. And as 'all generous minds have a horror of facts,' the engineers must learn how to express them in a style that will be welcomed by the public and will prevent the charlatans and opportunists leading the public astray.

"In my opinion, the proper organized outlet for this type of civic activity is through the Council of the Federated American Engineering Societies. It should speak for all engineers and must be single-tracked in its work to accomplish results, although composed of multiple-tracked elements consisting of the best and most experienced minds to be found in the profession of engineering."

In the words quoted President Ryan's vision and all-pervading humanity spoke clearly and convincingly sentiments and ideals that will find a ready response in the minds and hearts of his brother engineers. This humanitarian outlook is a measure of the man who will guide the Institute during the coming year. He is an indefatigable, creative and deep-thinking engineer possessing the true simplicity of strength and a deep and earnest element of sunshine and joyfulness. With sincerity shining in his countenance, he seems to be made for friendship, and his genial, open and sympathetic personality inspires admiration, love and respect.

"I have been informing myself about the activities of the Institute and am impressed and astonished by the great amount of good work it is doing and the many fields in which it is making its influence felt," continued Professor Ryan. "It is inspiring and stimulating to find this great body of more than 17,000 electrical men united in their efforts to advance the art and unanimous in their recognition of the value of scientific accomplishments. Only in our country can such a democratic organization exist with specialists, operating engineers, electrical business men and engineering students closely co-operating and working toward a common goal. It seems to me that American idealism is afforded an outlet through membership in this engineering organization which unselfishly labors to make engineering contributions for the benefit of mankind and recognizes and exalts technical proficiency. There is a feeling of personal pleasure and satisfaction derived from membership in a fellowship of this character which has such tremendous potentiality for beneficial accomplishments and expresses the standards and opinions of the profession.

THE ENGINEERS SHOULD SERVE

"And there seem to be many ways in which the engineers through the Institute can render service to each other and to the nation. The practical aspects of electrical engineering have reached a stage where they encroach upon the domain of research, and as a result it is encouraging and stimulating to find operating engineers vitally interested in the work of specialists and research workers because this condition makes for mutual understanding and rapid progress. Much can be done to interpret and apply the work of the specialists and research workers, because they usually talk in words and deal with mathematical tools difficult to comprehend by engineers having less mastery of technology. And every opportunity should be afforded the specialists for developing the art, and the encouragement of the rank and file of the members should stimulate them to renewed activity.

"In the field of education the Institute can be of service in maintaining technical standards. The de-

mand at present in the commercial world is for engineers to enter into business and executive positions, and this has been influential in decreasing the technical courses and increasing the other contents in many college curricula. All types of men are needed in industry and should be trained in the colleges, but in my opinion the art of electrical engineering has advanced so rapidly and become so extensive that the technical standards of the schools should be raised and research proficiency encouraged and rewarded. There is great hope of permanent and tangible progress in our civilization through new engineering contributions and methods which can be produced by numbers of skilled engineers and research workers, and this fact must not be forgotten by the industry or by the schools when dealing with the expediencies of the moment as reflected by the demands of industry."

KEEP BREADTH IN THE INSTITUTE

The interviewer was now sufficiently at ease to risk a leading question: "How does it feel to be president of the Institute and what do you consider the scope of its activities?"

"I was surprised that the Institute honored me with the presidency and feel humble yet enthusiastic about the task before me. Fortunately, my able predecessors have builded wisely and well and have generously and kindly done everything possible to perfect the organization and make my task easy. I have been studying the status and activities of the Institute for several weeks and have much work to do yet before I can speak with authority, but my personal feeling is that the Institute should be the capstone and all-inclusive organization in the theoretical aspects of electrical engineering. It must encourage the development of sections and promote and co-operate with the work of allied societies in the field of electrical engineering. But it should not narrow its technical scope or field of endeavor, and should embrace all electrical engineers for the purpose of advancing the art. The offshoot and allied societies have very important work to do, and they satisfy the necessity for engineers in specialized fields to discuss many details and all matters of current theory and practice. But the Institute should also present and discuss 'quality' material of fundamental and permanent character on all the theoretical phases of electrical engineering. This, in my opinion, will make for unity in the electrical profession, enhance its standing and more adequately recognize and reward the engineers who have contributed to the advancement of the art." Here President Ryan again emphasized the fact that he expressed his personal opinion.

ACT AS RESEARCH CONSULTANTS

"Professor Ryan, you have contributed greatly to the art through your research activities. In what way can the Institute encourage or do research work?" asked the interviewer.

"Research is a vital element in engineering progress," replied Professor Ryan. "It is not an easy thing to define or to accomplish and requires money and facilities for experimentation impossible for the Institute to furnish. But the Institute has available the most talented personnel in the profession, and through its technical committees can do much to further and encourage research work. The ground must be spaded and the problems defined by other agencies than the Institute, but once the data are assembled and the problems defined, it would seem feasible for the Institute committees to help in the solutions either directly or in consultation with those more responsible. Theoretical investigations involving analytical and mathematical studies by specialists could be made by the Institute committees, and they could co-operate and advise with workers actively engaged in the experimental investigations needed for the solution of other types of problems.

"Since the Institute committees are composed of impartial and carefully selected specialists in the several fields of endeavor—men who cannot be excelled in technical proficiency—I believe they could be extremely valuable as research consultants. How much of this kind of activity is carried on by the committees I do not know," said President Ryan in concluding the interview, "but to me it seems to offer very pertinent opportunities for services and achievements of the greatest importance to the profession."

Electrical engineers can feel honored in having at their head a man who can think so constructively and broadly on subjects so vital to the Institute and the profession. These are the sentiments of a level-headed, constructive organizer and thinker and yet they are the expressions of a man who is world-renowned for his technical contributions to the art. Specialist, educator, engineer and executive are all apposite characterizations of Harris J. Ryan, and these attainments make him a worthy torchbearer of the electrical profession. Yet the most distinct impression left with the interviewer was that these were incidental attributes of a great and courteous man who possessed an unusually sympathetic and inspiring personality.

Radio in France

THE use of wireless by private persons in France is already attaining considerable proportions, although not to nearly the same degree as in the United States. Private wireless sets for receiving broadcasted messages from Eiffel Tower and other near-by stations are advertised for sale. Any private person can own a wireless receiving set, but wireless sending outfits are only authorized by special license from the French government. An annual fee of 10 francs is charged by the French postal authorities to all owners of wireless receiving sets.

Broadcasting is carried out in the Paris region by the Eiffel Tower, the Société Française Radio Electrique and the Superior School of the Postal Telegraph and Telephone Services of the French government. The length of wave used by the Eiffel Tower is 2,600 meters, the principal items broadcasted being weather reports, stock exchange news and a radio concert every evening. The length of wave used by the Société Française Radio Electrique is 1,780 meters, the society broadcasting two radio concerts, one in the afternoon and the other in the evening. The Superior School broadcasts on a wave of 450 meters, its program including educational subjects and an evening concert. The Eiffel Tower service is government-owned and is sent out for the general public benefit. The Société Française Radio Electrique obtains its remuneration by the sale of special "Radiola" receiving sets adapted to the broadcasting system used. The Superior School service is likewise free of charge and carried out in the interests of education and experiment. The French military authorities are starting a trial system of broadcasting on a 45-meter wave.

Peoria's Automatic Substations

How Regulation Is Improved and Relief Afforded to Overloaded Pole Lines of 2,300-Volt Distribution Circuits Leaving Generating Station—Two 3,000-Kw. Automatic Substations Cost $53,392

By C. R. BUSH
Electrical Engineer Central Illinois Light Company, Peoria, Ill.

AS A RESULT of the rapid increase in lighting demand at Peoria the Central Illinois Light Company installed three automatic alternating-current substations during October and November, 1922. The old transmission system consisted of single phase 2,300-volt, 200-kw. two-wire primary feeders all radiating from the Liberty Street generating station on the river bank in the heart of the city. These circuits gradually became overloaded to such an extent that, regardless of the voltage regulators operating at maximum boost and carrying double their rated capacity, the voltage drop at the ends of the feeders was excessive; but owing to the development of the tungsten lamp, complaints of low voltage were not so pronounced as they might have been under the old conditions with carbon lamps.

LOAD DEVELOPMENT STUDIED

In order to determine what steps should be taken to relieve the situation, to provide capacity for future growth and yet install a system which could be readily expanded, a detailed study of load conditions was made covering the entire city divided into equal sections. From the feeder readings covering the five years 1916-1921 it was determined that the average yearly increase in load was 13 per cent.

Two solutions to the problem presented were then studied. The first was to change existing single-phase circuits to four-wire, three-phase circuits by doubling two circuits as far as possible and by adding additional copper wherever necessary, thereby making the equivalent of three circuits out of two existing circuits. This would involve the reconnection of all the generators and a complete change-over at the station from three-phase delta to three-phase star, or the installation of a bank of auto-transformers of sufficient capacity to feed the lighting load. This scheme involved many difficulties in making the change-over, and as it provided additional capacity for only two or three years, it was finally abandoned.

SUBSTATIONS AT DUCT ENDS

It was then decided to install three substations—one (Glendale) a mile north of the generating station, an exact duplicate (Lincoln), one mile south, and a smaller substation at Peoria Heights. Both the Lincoln and the Glendale substation were installed at the extremity of an existing underground duct system and were supplied by a 13,200 volt, three-phase underground cable loop. One No. 2/0 three-phase, three-conductor, 13,200-volt, 3,300-kw. cable feeds each substation, with a similar tie cable between the substations. This loop is protected by automatic breakers and inverse-time overload relays in such a manner that any one of the three sections is isolated in case of trouble without interrupting service. These substations were also erected in close proximity to what the study of the load showed to be the most heavily loaded sections, considering both present and future conditions.

The capacity of the substations was determined partly

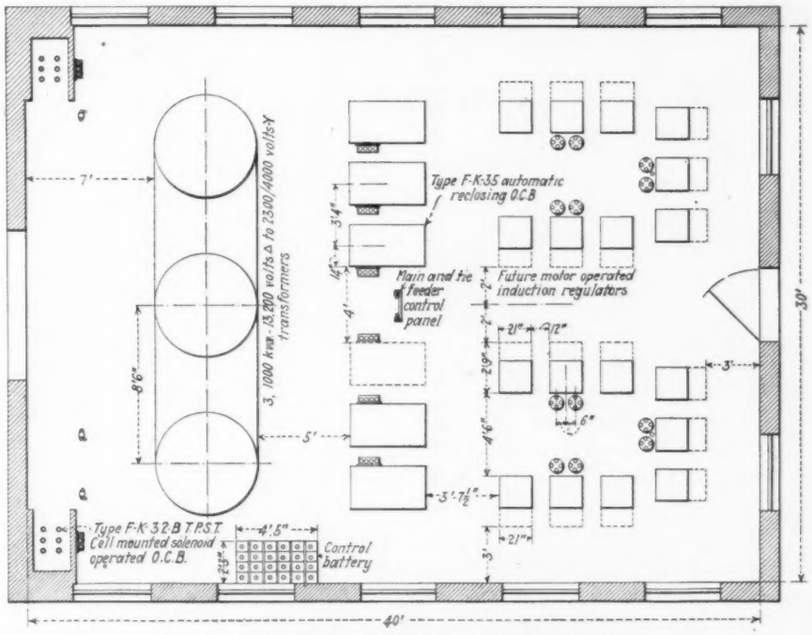

7'
3, 1000 kw - 13,200 volts Δ to 2300/4000 volts Y transformers
Type F-K-35 automatic reclosing O.C.B
Main and tie feeder control panel
Future motor operated induction regulators
Type F-K-32-B T.P.S.T Cell mounted solenoid operated O.C.B.
Control battery
40'
30'

FIG. 1—AUTOMATIC SUBSTATION LAYOUT WHICH IS CHARACTERISTIC OF PEORIA INSTALLATIONS

by the size of existing ducts through which the feeder cables were carried and partly by the distance it would be necessary to carry load when the substation was operating at capacity. This was determined by assuming that the most heavily loaded section had reached its ultimate capacity and that adjacent sections would ultimately develop the same load.

When these substations finally become loaded, the plan is to install a second loop around the city, possibly a mile farther out, supplying another row of substations. This system not only allows for unlimited expansion of the company's service, but will ultimately result in short feeders radiating from each substation and in giving good regulation.

EQUIPMENT COMPLETELY HOUSED

Each substation consists of a brick and concrete fireproof structure having a floor area of 30 ft. x 40 ft.,

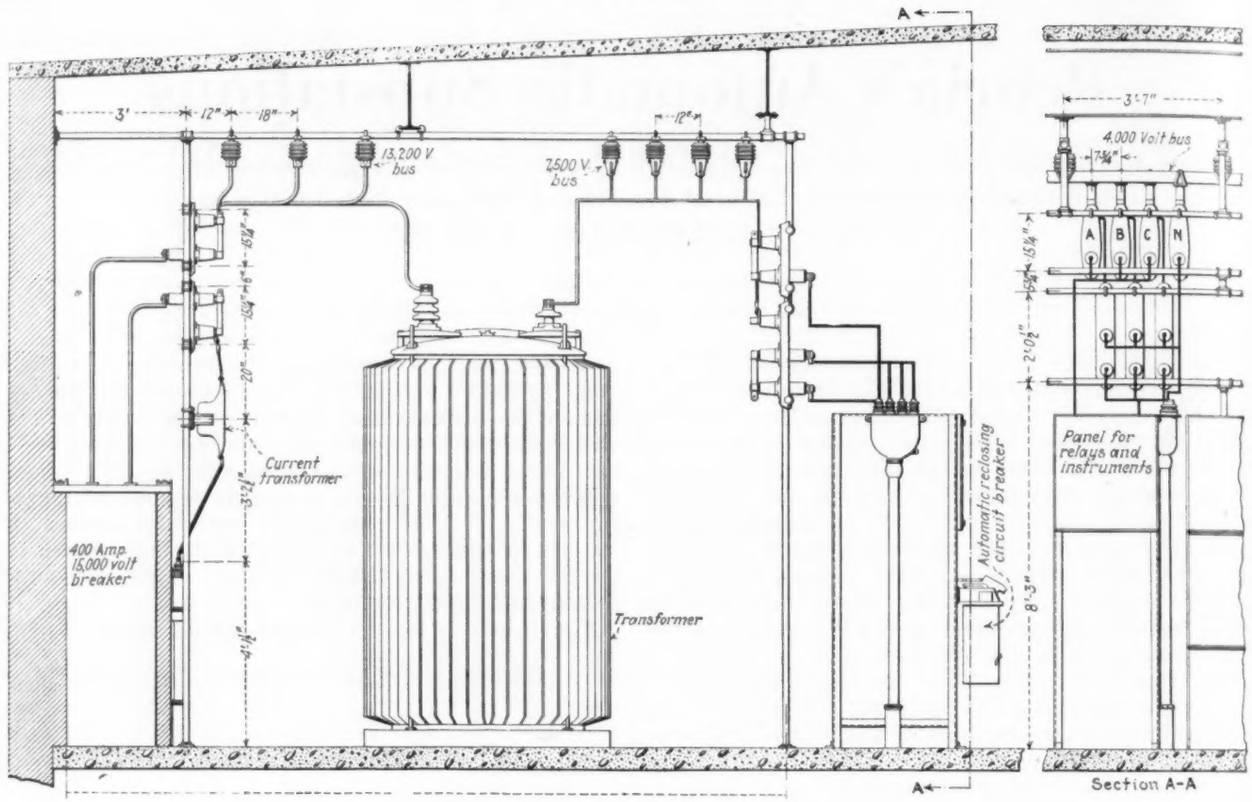


FIG. 2, A AND B—"DISCONNECTS" ARE ARRANGED SO THAT ANY FEEDER BREAKER MAY BE SHUNTED OUT OF SERVICE FOR INSPECTION AND REPAIR

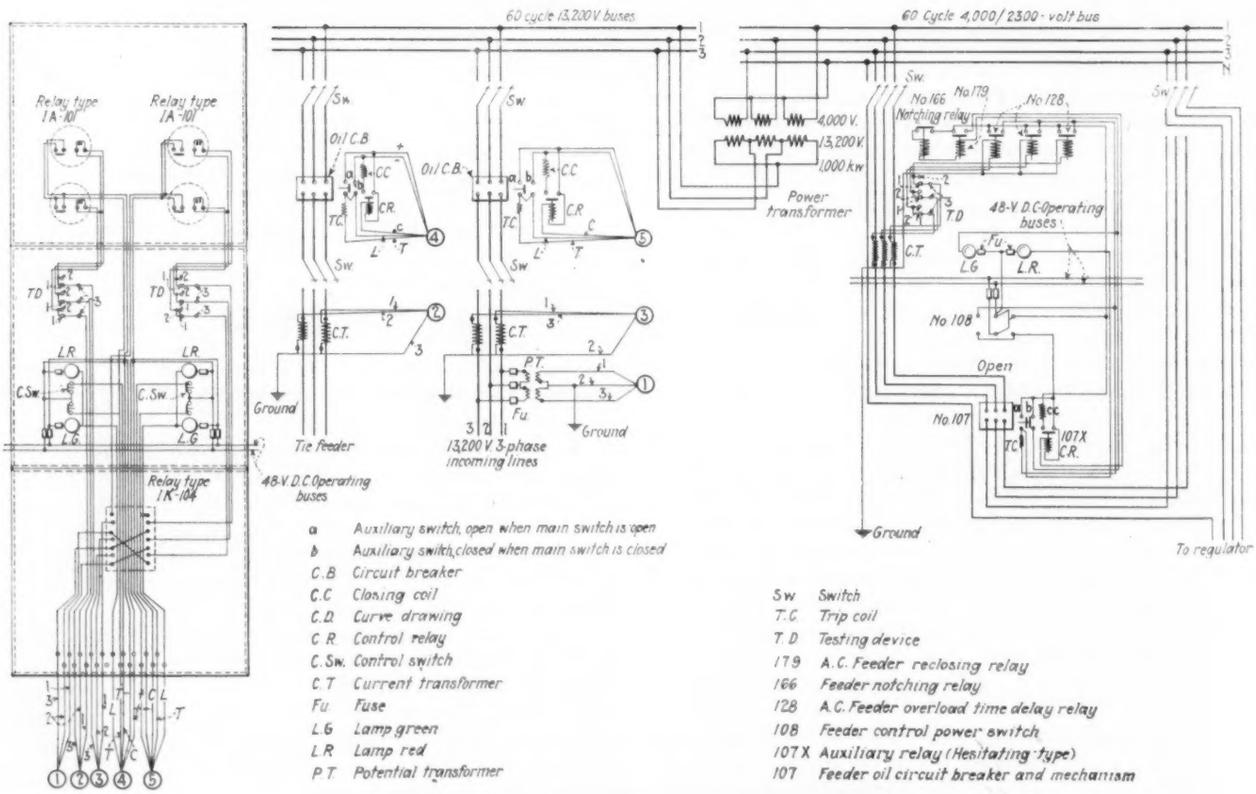


FIG. 3—CONNECTIONS OF AUTOMATIC RECLOSING EQUIPMENT

Each station houses three 1,000-kva., 13,200 (delta) 4,000-2,300-volt (star) single-phase self-cooled transformers feeding 4,000-2,300-volt buses with provisions for six three-phase, four-wire feeders. Provision is made for future installations of voltage regulators.

housing three 1,000-kva., 13,200 (delta)- 2,300/4,000 volt-star, single-phase self-cooled transformers, buses and switching equipment. These transformers feed a 2,300/4,000-volt bus from which provision has been made for taking six three-phase, four-wire feeders. Glendale substation has five circuits at the present time, while Lincoln has three. Provision has also been made for the future installation of voltage regulators. Transformer temperatures are registered on an external indicator, giving a direct check on load conditions. Louvers in the roof and walls of the substations allow a control of the indoor temperature. With closed louvers the transformers operated during January at between 45 deg. and 50 deg. C.

Feeder connections are made to the bus through an arrangement of single-blade, single-throw, and double-blade, double-throw disconnecting switches in such a manner that the oil circuit breaker protecting the feeder may be shunted out of the circuit for inspection and repairs while the feeder is connected directly to the bus during this operation. Inspections of breakers are made only during fair weather. If trouble should develop during this period, the automatic breakers on the incoming 13,200-volt feeders would still afford protection, although interrupting the entire substation load.

STORAGE BATTERY RECLOSES BREAKER

Each feeder panel consists of a type FK-35 400-amp., 7,500-volt solenoid-operated oil circuit breaker operated by means of three overload relays, one circuit-breaker-reclosing relay and one notching relay. Energy for operating this breaker is obtained from a 48-volt storage battery. Provision for charging this control battery is taken care of by a 6-amp. Tungar rectifier. The battery is placed on charge at a low rate for twenty-four hours every three weeks, but oftener if necessary, this being determined by the number of feeder-breaker operations which have occurred.

Weekly inspections of these substations are made, the inspector being required to make a thorough examination of all equipment at such times. Among his duties are the examination of connections and switches for signs of heating, addition of distilled water to the control battery where needed, testing the gravity of each cell and testing of all relays on reclosing units.

BREAKERS RECLOSE WITHIN SET TIME

If a ground or short circuit develops on a feeder, the overload relays function, thereby opening the breaker. After a predetermined interval, about thirty seconds, the contacts of the reclosing relay close, thereby closing the breaker. If the short circuit still persists, the breaker again opens and is again reclosed. Then if the short circuit still continues, the breaker opens a third time, but the contacts of the notching relay open and the breaker remains open until the notching relay is reset by hand, thus starting the cycle over again.

However, if the breaker opens once, but is reclosed and remains closed for a definite period of from two to three minutes, the notching relay returns to its original position and is ready to start on a new cycle. Thus a series of short circuits or overloads coming in at intervals of a few minutes will be cleared and the breaker closed without manual attention. The breaker may be operated manually by means of the double-throw switch No. 108, which causes the breaker to trip in one position while the automatic feature functions when in the other position.

SEQUENCE OF OPERATION

The control functions as follows:

1. An overload occurs on the line.
2. Overload relay No. 128 trips the circuit breaker.
3. Circuit breaker opens, auxiliary switch *b* on circuit breaker closes, energizing reclosing relay and notching relay.

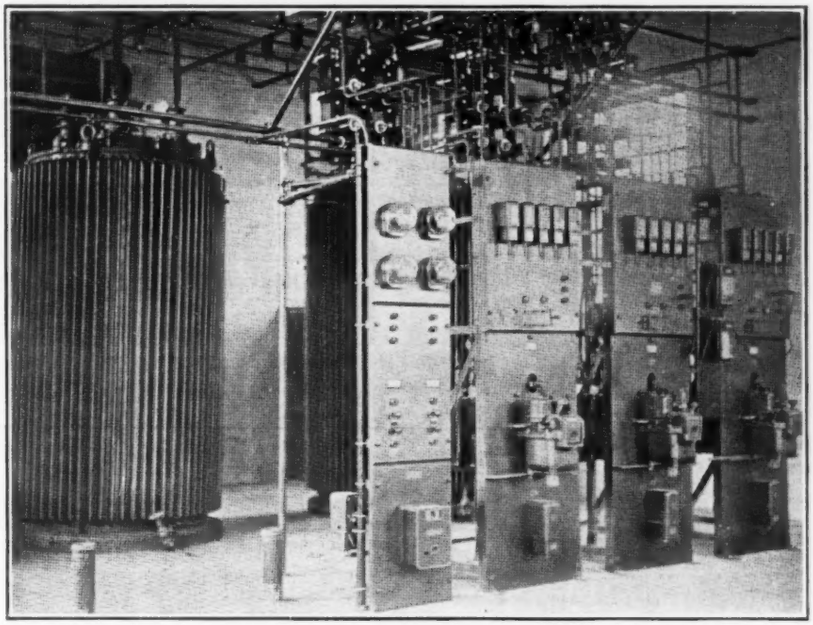


FIG. 4—AUTOMATIC RECLOSING SWITCHING EQUIPMENT AT LINCOLN SUBSTATION

4. Notching relay No. 166 advances one step instantly.
5. Reclosing relay No. 179 operates within definite time, permitting solenoid control relay on circuit breaker to be energized, causing circuit breaker to close.
6. Circuit breaker closes, auxiliary switch *b* on circuit breaker opens and auxiliary switch *a* closes, connecting trip coil and red lights.
7. Relay No. 179 opens and control relay on breaker opens.
8. Notching relay No. 166 starts to reset and will do so if breaker does not open within a predetermined time. The second opening of the breaker causes the relay to notch the second step, but the relay contacts are not opened. With the third relay breaker opening, the relay notches to the third step, thereby opening the contacts, which locks the apparatus out; but if the breaker had remained closed after the first or second step, the relay would have returned to its original position ready for a fresh sequence of relay and breaker operation.

Peoria Heights substation is about 4 miles north of the main station and is supplied with 13,200-volt, three-phase power from a tap on one of the transmission lines. This substation has a capacity of 300 kw. and is connected the same as the Glendale and Lincoln substations, two three-phase, four-wire feeders leaving the substation to serve outlying light and power consumers in Peoria Heights. The reclosing device on this breaker is motor-actuated, taking power from a 110-volt transformer connected through line cut-outs to

Generator and Prime-Mover Equipment of the Central Stations of the United States as of Oct. 1, 1922

States and Sections	Operating Companies			ELECTRIC GENERATORS							PRIME MOVERS					Water Wheels and Water Turbines	Boilers
							Private Plants		Municipal Plants								
	Total	Private	Municipal	Total Rating Kva.	A.C. Rating Kva.	D.C. Rating Kw.	A.C. Kva.	D.C. Kw.	A.C. Kva.	D.C. Kw.	Total Rating, Hp.	Steam Engines Rating, Hp.	Steam Turbines Rating, Kw.	Gas Engines Rating, Hp.	Oil Engines Rating, Hp.	Rating, Hp.	Rating, Hp.
United States	5,974	3,955	2,019	17,715,484	17,293,551	421,933	16,379,603	403,313	913,948	28,620	19,847,246	1,758,025	8,782,961	92,902	141,177	6,144,527	4,235,455
New England	391	328	63	1,732,813	1,697,524	35,289	1,664,810	35,289	32,714	0	2,004,610	116,682	1,000,608	1,185	2,014	550,585	304,200
Middle Atlantic	664	557	107	3,886,599	3,849,274	37,325	3,796,147	36,105	53,127	1,220	447,604	307,151	2,437,515	15,205	3,584	900,081	990,545
South Atlantic	700	418	282	2,237,421	2,195,541	41,880	2,088,001	40,881	107,540	999	2,465,613	275,166	847,911	16,232	6,072	1,037,595	443,683
East North Central	1,257	802	455	4,263,955	4,117,993	145,962	3,821,674	137,854	296,319	8,108	4,535,599	439,564	2,630,809	13,380	12,728	562,182	1,183,916
West North Central	1,460	767	693	1,472,553	1,406,903	65,650	1,262,604	63,688	144,299	11,962	1,697,983	244,397	725,139	27,410	50,311	409,013	496,627
East South Central	370	232	138	600,034	580,928	19,106	544,380	17,510	36,548	1,596	592,284	85,868	191,118	660	5,004	245,928	203,348
West South Central	588	414	174	662,652	624,834	37,818	575,136	36,998	49,698	820	757,963	172,212	385,007	15,659	48,663	8,086	273,779
Mountain	308	248	60	951,499	938,574	12,925	922,508	12,655	16,066	270	1,107,846	57,971	104,952	1,849	9,536	898,554	118,410
Pacific	236	189	47	1,907,958	1,881,980	25,978	1,704,343	22,333	177,637	3,645	2,209,307	59,014	459,902	1,322	3,265	1,532,503	220,947
NEW ENGLAND																	
Maine	78	73	5	142,129	134,719	7,410	133,257	7,410	1,462	0	151,725	12,573	11,987	125	150	122,894	14,140
New Hampshire	57	54	3	79,121	75,328	3,793	73,878	3,793	1,450	0	92,179	11,950	33,499	760	450	34,354	18,537
Vermont	63	51	12	123,335	121,550	1,785	115,560	1,785	5,990	0	155,587	7,820	9,475	0	9	135,125	10,432
Massachusetts	135	98	37	914,361	900,300	14,061	877,238	14,061	23,062	0	1,092,352	72,679	603,747	300	280	214,097	157,422
Rhode Island	12	10	2	215,425	212,475	2,950	212,475	2,950	0	0	232,862	2,820	170,818	0	0	2,285	28,163
Connecticut	46	42	4	258,442	253,152	5,290	252,402	5,290	750	0	279,904	8,840	171,082	0	1,125	41,830	75,506
MIDDLE ATLANTIC																	
New York	356	309	47	1,985,117	1,973,825	11,292	1,939,752	11,292	34,073	0	2,381,479	115,175	1,127,220	3,790	1,864	757,690	450,335
New Jersey	61	46	15	348,467	346,966	1,501	342,792	1,476	4,174	25	369,636	97,261	201,665	1,115	1,100	1,273	135,909
Pennsylvania	247	202	45	1,553,015	1,528,483	24,532	1,513,603	23,337	14,880	1,195	1,724,926	94,715	1,108,630	10,300	620	141,118	404,301
SOUTH ATLANTIC																	
Delaware	15	9	6	35,287	32,342	2,945	31,225	2,585	1,117	360	38,863	5,885	24,580	25	30	150	14,135
Maryland	47	37	10	278,834	272,512	6,322	266,822	6,170	5,690	152	290,776	44,532	181,590	660	95	3,369	77,021
District of Columbia	3	3	0	91,850	87,000	4,850	87,000	4,850	0	0	99,600	6,800	69,600	0	0	0	26,850
Virginia	96	74	22	243,216	234,643	8,573	218,847	8,473	15,796	100	278,335	12,926	162,130	272	530	48,434	64,157
West Virginia	71	64	7	449,612	441,005	8,607	440,265	8,607	740	0	427,739	116,476	195,233	10,530	20	40,402	86,157
North Carolina	139	76	63	177,909	175,714	2,195	155,697	2,195	20,017	0	210,529	22,288	47,823	200	865	123,412	47,356
South Carolina	81	51	30	453,873	451,378	2,495	432,795	2,455	18,583	40	541,137	8,820	51,240	3,000	562	460,435	24,467
Georgia	161	56	105	392,140	388,897	3,243	370,516	3,231	18,381	12	478,862	40,528	62,543	200	350	354,393	72,561
Florida	87	48	39	114,700	112,050	2,650	84,834	2,315	27,216	335	99,772	16,911	53,172	1,345	3,620	7,000	30,979
EAST NORTH CENTRAL																	
Ohio	281	169	112	1,278,441	1,240,155	38,286	1,154,123	34,616	86,032	3,670	1,377,284	110,256	925,967	5,323	3,255	24,094	365,139
Indiana	216	140	76	425,638	402,998	22,640	337,570	21,253	65,428	1,387	426,693	58,058	266,144	705	1,805	11,266	178,784
Illinois	287	196	91	1,210,241	1,157,806	52,435	1,102,121	51,034	55,685	1,401	1,302,820	150,484	824,017	1,340	2,492	49,815	359,888
Michigan	199	113	86	812,028	803,743	8,285	732,666	7,273	71,077	1,012	857,218	51,197	433,555	847	2,634	224,467	151,212
Wisconsin	274	184	90	537,607	513,291	24,316	495,194	23,678	18,097	638	571,585	69,569	181,326	5,165	2,542	252,540	128,893
WEST NORTH CENTRAL																	
Minnesota	220	103	117	349,162	325,794	23,368	301,915	21,087	23,879	2,281	415,084	41,099	133,426	3,342	2,732	190,010	88,254
Iowa	225	129	96	352,112	333,341	18,771	317,869	15,355	15,472	3,416	370,857	65,803	102,451	1,440	4,010	163,003	109,158
Missouri	241	169	72	435,230	422,564	12,666	404,340	12,401	18,224	265	496,748	44,234	309,719	3,500	6,435	29,620	135,273
North Dakota	129	99	30	27,062	19,806	7,256	18,061	5,839	1,745	1,417	34,481	21,178	6,467	2,620	2,060	0	22,949
South Dakota	117	73	44	39,320	37,340	1,980	32,345	793	4,995	1,187	48,527	11,680	14,418	6,511	7,282	3,830	20,215
Nebraska	265	113	152	120,088	127,596	6,492	103,986	3,687	19,610	2,805	139,472	27,496	64,922	2,009	10,097	13,307	52,661
Kansas	263	81	182	149,579	144,462	5,117	84,088	4,526	60,374	591	192,814	32,907	93,736	7,988	17,695	9,243	68,117
EAST SOUTH CENTRAL																	
Kentucky	113	91	22	127,220	121,553	5,667	115,072	5,202	6,481	465	78,386	23,567	38,583	610	2,320	445	50,363
Tennessee	98	67	31	208,420	203,355	5,065	194,400	4,287	8,955	778	206,383	18,125	44,585	25	400	128,386	55,118
Alabama	68	33	35	215,633	210,246	5,387	204,682	5,331	5,564	56	253,378	26,022	82,664	0	40	117,097	69,825
Mississippi	91	41	50	48,761	45,774	2,987	30,226	2,690	15,548	297	54,138	18,154	25,286	25	2,244	0	28,042
WEST SOUTH CENTRAL																	
Arkansas	89	68	21	79,824	74,042	5,782	68,151	5,732	5,891	50	71,619	27,612	28,910	660	1,600	3,200	43,716
Louisiana	73	36	37	97,798	80,064	17,734	65,279	17,104	14,785	630	118,980	32,907	58,517	740	7,310	0	35,300
Oklahoma	149	61	88	136,267	131,892	4,375	110,870	4,250	21,022	125	163,071	50,899	70,259	5,923	11,062	1,508	68,292
Texas	277	249	28	348,763	338,836	9,927	330,836	9,912	8,000	15	404,293	60,794	227,321	8,336	28,691	3,378	126,471
MOUNTAIN STATES																	
Montana	57	52	5	410,051	408,975	1,076	406,923	1,076	2,052	0	483,647	10,509	2,467	195	1,068	468,579	11,188
Idaho	43	30	13	165,423	164,928	495	162,336	350	2,592	145	213,600	2,725	1,200	40	20	209,215	2,990
Wyoming	38	30	8	32,890	32,033	857	30,139	857	1,894	0	33,439	8,980	14,915	840	1,762	1,970	15,834
Colorado	61	53	8	153,029	143,612	9,417	138,705	9,367	4,907	50	166,403	20,209	50,392	270	275	78,460	50,925
New Mexico	27	23	4	12,469	11,764	705	10,131	705	1,633	0	13,250	5,685	3,800	0	1,840	658	7,806
Arizona	31	28	3	64,230	63,930	300	63,880	300	50	0	67,265	9,485	17,978	22	4,171	29,616	20,891
Utah	36	18	18	99,902	99,827	75	96,889	0	2,938	75	114,906	63	12,800	0	0	97,776	7,276
Nevada	15	14	1	13,505	13,505	0	13,505	0	0	0	15,344	315	1,400	482	400	12,280	1,500
PACIFIC																	
Washington	97	81	16	426,038	412,671	13,367	318,956	9,867	93,715	3,500	350,188	16,009	66,469	40	230	245,284	48,222
Oregon	56	43	13	180,417	171,733	8,684	167,436	8,539	4,292	145	230,917	12,730	61,938	142	585	134,876	29,901
California	83	65	18	1,301,503	1,297,576	3,927	1,217,951	3,927	79,625	0	1,628,201	30,275	331,495	1,140	2,450	1,152,343	142,824

the low-tension side of the main bank of transformers, which are mounted outdoors.

The total cost of the Glendale substation, now supplying five feeders, was $28,322.40, which is divided into $3,000 for land, $6,000 for building and $19,322.40 for electrical equipment installed. The cost of the Lincoln substation, supplying three circuits, was $3,500 for land, $5,800 for the building and $15,670 for electrical equipment. Peoria Heights substation cost $5,695.38, which is divided into $5,195.38 for electric equipment and building and $500 for land.

The specific advantages gained by this change-over are as follows: The same load is now carried by the two 13,200-volt, three-phase underground cables as was handled by the former nine single-phase circuits. This has resulted in relieving the pole lines from the generating station of eighteen runs of No. 1/0 wire. Voltage regulation at feeder ends has also improved since the feeders have been shortened and owing also to the increase in voltage from 2,300 to 4,000. Service to outlying three-phase power consumers is now better provided by carrying the substation three-phase feeder out from the Peoria Heights substation direct to the consumers. This has allowed a shortening of the regular three-phase feeders, thereby giving an improved voltage regulation. Another advantage in installing automatic substations was that the expense of station operators was eliminated.

Central-Station Generator Ratings Total 17,715,484 Kva.

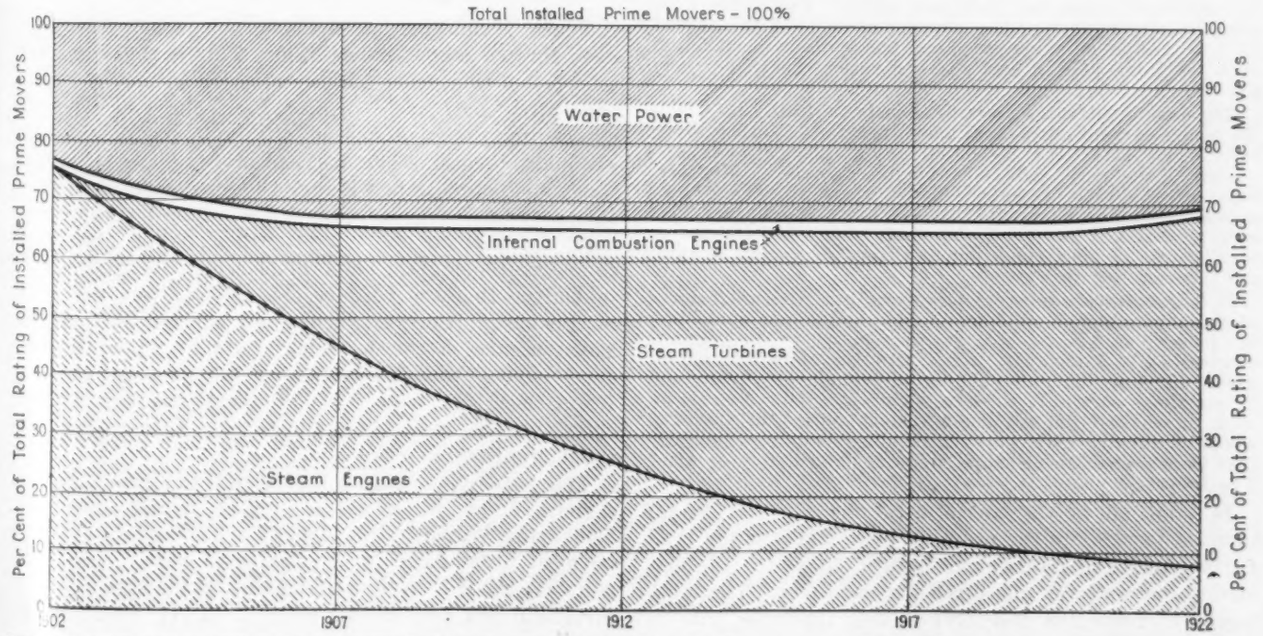
On Oct. 1, 1922, there Were 5,974 Generating and Transmission Systems in the United States, of Which 66.3 per Cent Were Privately Operated

A TABULATION based upon equipment reports as published in the 1923 edition of the McGraw Central Station Directory indicates that on Oct. 1, 1922, there were a total of 5,974 central-station systems operating in the United States. Of this number 3,955, or 66.3 per cent, were commercial or privately owned, and 2,019, or 33.7 per cent, were operated by municipalities. The West North Central States reported the largest number of systems with 1,460, of which 693, or 47.5 per cent, were municipally operated. The three other central sections and the South Atlantic States also reported high percentages of municipally operated systems. In the Northeastern and Mountain-Pacific sections the municipal systems were of much less importance in so far as number of unit systems was concerned.

The combined rating of the generators installed in the central generating plants of the country is given as 17,715,484 kva., of which 17,293,551 kva., or 97.6 per cent, represents the rating of alternating-current generators and 421,933 kw., or 2.4 per cent, is the rating of direct-current generators. The commercial or privately operated plants reported 16,782,916 kva., or 94.7 per cent, of the total generator rating. Although the three Pacific States reported the lowest number of municipal systems of any section, yet three of these systems are of such size as to bring the total generator rating of municipal plants in this section to a figure second only to the municipal systems in the East North Central States.

As indicated in the accompanying table, the prime movers in the central generating plants total 19,847,246 hp. The relative importance of the various types of prime movers is clearly indicated in the diagram below. It will be noticed that the percentage relation between steam-driven and water-driven prime movers has remained almost stationary for the past fifteen years, with a slight increase in favor of steam during the last five-year period. The total rating of internal-combustion engines as compared to the total prime-mover rating has also remained almost stationary, about 1.5 per cent of the total. The total boiler rating is given as 4,235,455 hp.

The Pacific States lead in the rating of waterwheels and water turbines with 1,532,503 hp., followed by the South Atlantic States with 1,037,595 hp. The total for the country of 6,144,527 hp. is 1,867,254 hp., or 43.4 per cent, above the total waterwheel and water-turbine installation as reported by the 1917 Census.



WITH THE ADVENT OF GENERATORS ABOVE 5,000 KW. THE STEAM TURBINE BECAME A NECESSITY IN CENTRAL GENERATING PLANTS

Accuracy Test for Transformers

Direct-Current Component Upsets Ratio—Error in Measuring Initial Peak—Not Accurate for Transient Measurements

IN CONNECTION with tests for determining mechanical strength and thermal limitations of common types of voltage transformers, the Pennsylvania Power & Light Company and the Consolidated Gas, Electric Light & Power Company tested the accuracy of the instruments during the short-circuit period. The other test results are given in the ELECTRICAL WORLD for July 28 and J. E. Allen of the Pennsylvania Water & Power Company has submitted the data for the accuracy tests given in this article.

TESTS FOR RATIO BREAKDOWN AT HIGH CURRENTS

Two types of transformers, namely FB-2,000/5 and D21-300/5, were tested for accuracy during short circuit. The observations follow:

FB-2.000/5.—Three tests were made on the transformer at effective currents of 18,300, 25,400 and 29,400 amp. (tests 236-238). The secondary loading was made on a 0.1-ohm shunt. Previous to test 236 the transformer was demagnetized by passing full-load current through the secondary with the primary open and gradually reducing the current to zero. The primary and secondary currents were measured with shunts in connection with the oscillograph.

The results of the three tests were quite interesting. In the first test No. 236 (oscillogram, Fig. 10) the primary had a large direct-current component (displacement 1.55). It was noted that the secondary current during the transient period did not have the same general characteristics as the primary current, and the ratio was much higher during this period than for the symmetrical period of the short circuit. For the first half cycle the ratio was as much as 54 per cent too high, but gradually it became lower until it reached a final value of 8.5 per cent too high after about 8 cycles. The secondary current, after being displaced downward in the first half cycle, became displaced upward in the following 4 or 5 cycles, after which time it again became symmetrical.

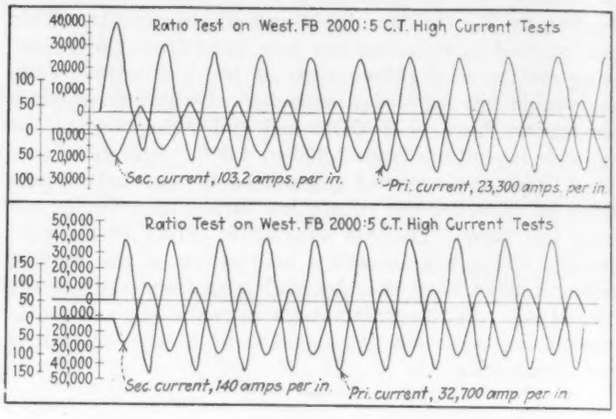
In contrast with the above test were the results of the two following tests, Nos. 237 and 238 (oscillogram, Fig. 11), in which there was virtually no direct-current component in the primary current of either test and in which the ratio did not vary after the first half cycle. The ratio, however, becomes higher at the higher currents. Thus, in test 237, at 25,400 effective amperes, the ratio was 10.5 per cent too high, and in test 238 the ratio was 16 per cent too high.

The results of the above three tests indicated that it is the direct-current component which upsets the ratio. However, even after the direct-current component has disappeared the ratio still is seriously in error. Measurement of the ratio after the above tests at normal load showed that the nominal ratio of the transformer was correct within 1 per cent, thus indicating that the transformer was in good condition and that the errors in ratio are inherent for this type.

It is generally admitted, however, that in transformers of the through type, such as the one tested, the ratio does not hold up so well as in a transformer where the primary consists of a number of turns, and therefore the errors given for tests 237 and 238, at overloads at twelve and fifteen times normal load, were not unexpected. But errors such as existed during the transient period of test 236 would naturally give very misleading results, especially if it were desired to measure currents immediately or after 3 or 5 cycles.

In addition to the above ratio tests, it is also of interest to refer to the previous tests made on the D-21 for thermal and mechanical failure, in which the secondary current was measured for each test. The oscillograms (tests 218 and 229) clearly indicated that in the first half cycle the ratio breakdown is much worse than for the succeeding cycles. However, the overload in these tests was eighty and a hundred times full load respectively, which accounts for the non-sinusoidal secondary wave.

But even the tests on the FB type have the same characteristics in the first half cycle. All of the foregoing tests, then, would indicate that current transformers are subject to considerable error in measuring the initial peak especially when it is displaced. The fact is further confirmed in comparing the initial displacement on the oscillograms when using a current transformer with the initial displacement when using a shunt when measuring currents of approximately the same magnitude. In the former case, when using the current transformer, out of a total number of 190 tests displacements of 45 to 50 per cent were obtained only six times, and the highest was only 50 per cent. In the latter case, when using a shunt for measurement, out of a total number of thirty-one tests, displacements of 50 per cent and over were obtained in seven tests, and the highest was 95 per cent.


Ratio Test on West. FB 2000:5 C.T. High Current Tests
Sec. current, 103.2 amps. per in.
Pri. current, 23,300 amps. per in.
Ratio Test on West. FB 2000:5 C.T. High Current Tests
Sec. current, 140 amps. per in.
Pri. current, 32,700 amp. per in.

AT TOP—TEST 236 ON FB-2,000/5, SHOWING DISPLACEMENT OF PRIMARY. AT BOTTOM—TESTS ON FB-2,000/5, SHOWING NO DISPLACEMENT OF PRIMARY

A CURIOUS DISPLACEMENT OCCURRED

There is another phenomenon on which the tests have thrown some further light. This is the characteristic found in a great number of oscillograms of having the initial half cycle displaced on one side and the succeeding cycles displaced on the opposite side but gradually becoming symmetrical in 4 to 6 cycles. There was some doubt as to whether the phenomenon was due to the furnace transformer or the current transformer used for measuring. Later, when using the shunt for measurement, the same displacement occurred, thus indicating that the furnace transformer was the cause in this case. However, in test No. 236 the phenomenon again occurs in the secondary current when the primary current measured with a shunt does not show it. From these few tests it would seem that the phenomenon noted is due to both the furnace transformer and the current transformer.

The ratio tests clearly point out the possibility of serious error when using current transformers for measuring transient phenomena. The error seems to be most pronounced in the first half cycle. The three tests on the *FB* type would seem to indicate that the direct-current component, when it exists, produces additional sources of error.

Amsteg Station in Switzerland

New Power House for Use on the Gotthard Electrification—Details of the Design of the Station and of the Transmission Systems

By HENRY L. GEISSEL
Thoune, Switzerland

ABOUT two years after electric traffic on the Gotthard Railway had been begun by utilizing the energy generated at the Ritom power station on the Italian side of the Gotthard tunnel, the Amsteg power station on the German side of the tunnel was put in operation. These two large power stations will, on their final completion within a few years, co-operate in such a way that the Amsteg power station alone will supply the energy in the summer during the high-water period of the Reuss River—a wild mountain stream—while the Ritom power station will remain idle and its incoming water be stored in the Lake of Ritom. During the winter the Ritom power station will supply from its storage lake the energy otherwise not available on account of the low water level of the Reuss. By means of this co-operation of the Amsteg and Ritom power stations and the smaller substation at Göschenen, at the entrance of the Gotthard tunnel, an average production of 32,000 hp. throughout the whole year will be available. The storage reservoir of the Lake of Ritom and that of the Pfaffensprung—to which reference will be made later on—also fully compensate for the load fluctuations so perceptible in railway operation. The group of power stations on the Gotthard will be able to feed the 525-km. lines of the Swiss Federal Railways even then, when the present traffic should be surpassed by about 50 per cent.

The Amsteg power station utilizes the fall of the Reuss, extending from the Pfaffensprung to the village of Amsteg, the water being caught in the very narrow gorge of the Pfaffensprung. By means of an arch-shaped dam a day compensating and clearing basin with storage of 200,000 cu.m. has been created. In order to draw off the high water and to reduce the accumulation of rubble in the storage reservoir, the Reuss River has been diverted by a tunnel 280 m. long at the upper part of the reservoir. The water flows from the storage reservoir through a pressure gallery 7.5 km. long on the right side of the valley into a reservoir entirely blasted out of the rock, into which the water of the Kärstelenbach is also conducted through an open gallery. Connected with this reservoir, the object of which is to compensate for pressure changes, is the pressure line. On emerging from the mountain it passes through a special chamber equipped with automatically closing throttles, in case of the pipe bursting, and leading to the central station. Along this pipe line an electric cable railway has been constructed.

DETAILS OF STATION

The station consists of a machinery house with adjoining buildings for pipes and check valves for the distribution of the running water to the turbines; a building for the 150-volt switching equipment with switchboards, transformer room, workshops and the 60,000-volt switching installations, rooms for the transformation of electrical energy for the lighting and heating purposes of the station, and three dwelling houses with fourteen apartments for the engineer's staff. Rooms for officers are in a separate building.

In the machinery room space is available for six

DATA ON RATING AND EQUIPMENT OF AMSTEG POWER STATION

Capacity

	Horsepower from Turbine
(a) Amsteg power station, utilizing the water powers of the Reuss, Fellibach, Kärstelenbach and Etzlibach:	
Winter—minimum, twenty-four hours	10,000
Winter—average (November to April)	17,000
Summer—average (May to October)	32,000
Summer peak load at first installation with four single-phase generators	54,000
Summer peak load at ultimate installation with six single-phase generators	80,000
(b) Group of Amsteg, Göschenen and Ritom power stations:	
Average capacity for whole year.	32,000
Peak load of Ritom power station	50,000
At ultimate installation	73,000

Gallery for Reuss Diversion

Length, m.	280
Cross-section, sq.m.	21.2
Fall, per cent.	3

Pressure Line

Length, m.	450
Number of traces when completed	3
Clear diameter of pipe at top, mm.	1,800
Clear diameter of pipe at bottom, mm.	1,600
(Installation: Upper part riveted, lower part annealed, reinforced by steel rings at the bottom.)	

Pressure Gallery

	Horsepower
Length, m.	7,535
Cross-section, sq.m.	6.45
Fall, per cent.	1.5
Pressure, fluctuating with water level in compensating reservoir, m. (water column)	20 to 35

Water Storage at Pfaffensprung.

Capacity of compensating reservoir, cu.m.	200,000
Length of dam at crown, m.	35
Greatest height of dam, m.	32
Volume of dam, cu.m.	200

Generators

(1) Single-phase alternating current:	
Number at first installation	4
Number at final installation	6
Continuous capacity of each generator, kw.	7,500
Power factor, per cent.	75
Maximum rating (1½ hours) kw.	9,500
Voltage	15,000
Frequency	16⅔
Revolutions per minute	333
Weight of generator, tons	250
(2) Three-phase alternating current:	
Number (for the present)	1
Continuous capacity, kw.	9,100
Power factor, per cent.	70
Maximum rating (half hour), kw.	9,100
Voltage	8,600
Frequency	50
Revolutions per minute	300
Weight of generator, tons	125

Turbines

	Horsepower
Number at first installation	3
Number at final installation	6
Capacity of each turbine, hp.	13,600
Average net fall, m.	275
Amount of water at full load, cu. m. per. sec.	4.73
Revolutions per minute:	
(a) Of the single-phase generators	333
(b) Of the three-phase generators	300
Wheels per turbine	2
Nozzles per shaft	1
Weight of turbine, tons	93

Transformers

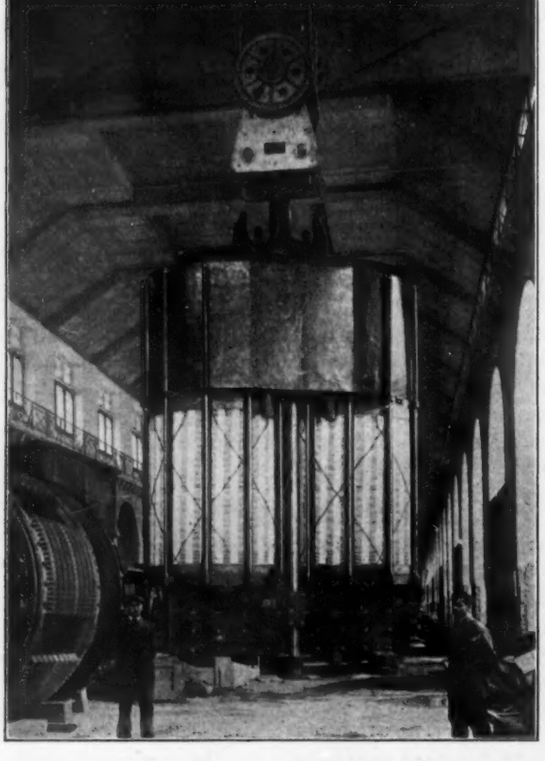
Number at first installation	4
Number at final installation	6
Continuous power of each transformer, kw.	7,500
Power factor, per cent.	75
Maximum rating (1½ hours), kw.	9,000
Transformation ratio, volts	15,000 to 60,000
Frequency	16⅔
Weight of transformer with oil, tons	49

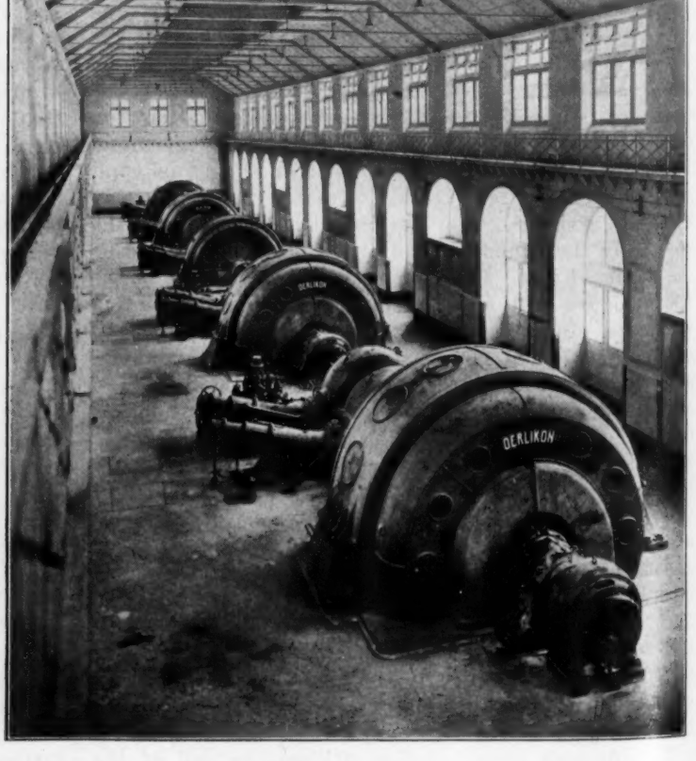
Branch Lines

For direct feeding of traction:	
Four copper conductors, each, sq.mm.	100
Voltage	15,000
Transmission lines:	
To the south, four cables, each, sq.mm.	135
Pressure between conductor and earth, volts	30,000
Pressure between conductor and conductor, volts	60,000
To the north, eight copper conductors, each, sq.mm.	95
Voltage	60,000

groups of machines. Five of them are now installed. An electric traveling crane of 100 tons serves for mounting and dismounting machinery. Each turbine has two Pelton waterwheels supplying 13,600 hp. at 333 r.p.m. and 275 m. head. The waste water of each turbine flows through a canal provided with water-measuring overflow weir and is conducted through a collecting tunnel into the Reuss River.

Four turbines are coupled to single-phase generators for a maximum capacity of 9,500 kw. each with a power factor of 0.75, each corresponding to 1,268 kva. at 1,500 volts and 16⅔ cycles. One turbine drives a three-phase





ONE OF THE SIX 10,000-KVA., 15,000/60,000-VOLT TRANSFORMERS
Two Pelton wheels with a combined rating of 13,600 hp. drive each generator.

generator of 9,100 kw. continuous capacity with a power factor of 0.70, corresponding to 13,000 kva. at 8,600 volts and 50 cycles. The three-phase current is conducted to the works of the Swiss Power Transmission Company, where it is transformed in a special transformer station to 50,000 volts (ultimately 78,000 volts) and then transmitted to the distribution lines of several electric plants. The Amsteg power station will, however, supply this three-phase current for industrial purposes only for the time during which it is not required for railway traction.

The single-phase current is transmitted by cable from the generators to the building housing the 15,000-volt switching apparatus. The smaller part of the energy goes into the overhead wire at 15,000 volts, the larger part by cable into the transformers in order to be transformed to 60,000 volts. For economically favorable energy transmission at great distances the tension is raised to 60,000 volts and transmitted by special lines to the substations, the principal feeding points, where it is again reduced to 15,000 volts for feeding the trolley wires.

In the Amsteg power station there is room for the installation of six transformers each of 10,000 kva. capacity, with transmission at from 15,000 volts to 60,000 volts, and the proper oil-cooling installations and settling ponds. Four transformers are now installed. The transmission line to the south consists of four underground copper cables of 133 sq.mm. cross-section, leading by way of the Göschenen substation to the Ritom power station and farther down to the Giornico substation. To the north runs an overhead transmission line on steel poles. It comprises eight copper conduits of 95 sq.mm. cross-section for the transmission of single-phase current at 60,000 volts to the Steinen substation and three aluminum conduits of 191 sq.mm. cross-section for three-phase current of 50,000 volts (ultimately 78,000 volts) for transmission, as mentioned, by the Swiss Power Transmission Company.

The completion of the Amsteg power station required 800,000 man-days, 180 tons of explosives and 150,000 tons of cement. Construction up to the present time has involved an expenditure of 44,000,000 francs and, when ultimately completed, a total of 50,000,000 francs, or about $10,000,000, will be reached.

Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

Underground Transmission at 150,000 Volts

To the Editors of the ELECTRICAL WORLD:

I was very much interested in the comments of William Del Mar, appearing in your issue of May 12. However, there is one point on which it would appear that Mr. Del Mar has not quite got my idea. It is where he says: "All the advantages of the scheme would not be lost if ordinary triplex cables were used, as its essence is to place conductors between which the diametric voltages are imposed in different cables and thus split the insulation into separate elements."

I have thought a good deal on the question of endeavoring to use ordinary triplex cables, and though I might agree with him that all of the advantages of my proposed scheme would not be lost, yet I think that the great bulk of them would thus disappear.

What I contend is that the employment of thin concentric insulations with intersheaths charged at controlled potentials effects an enormous reduction in the duty performed and the space occupied.

It may help both Mr. Del Mar and other readers of the ELECTRICAL WORLD who may be interested if they refer to an article which I recently contributed to the *Electrical Review* (London) for April 27 and May 4. In this article not only have I pointed out the advantages *per se* of intersheaths, but in particular I have compared an ordinary triplex cable worked in the ordinary way with an intersheath cable. From this it may be seen that considerable effort will have to be expended to get the three conductors into the one cable and to insulate them individually from one another and from earth. Furthermore, a great amount of space is required. If the same space is utilized to introduce intersheaths on a single-core cable, a tremendous gain is effected at once.

Another point of the greatest importance is that it is practically impossible, with a reasonable diameter of cable, to use an ordinary triplex cable, working at, say, 50,000 volts, with more copper than, say, 0.15 sq.in. per phase, because the maximum potential gradient runs up to a dangerous figure if a greater cross-section be attempted.

There is also another factor which greatly favors the employment of an intersheathed single-core cable, namely, that the whole of the waste heat due to three phases is liberated in a single cable of the triplex type, whereas only that due to one phase is liberated in the cable of the type I am proposing.

On the question of "complication" may I be allowed to say that all I do is to convert three-phase into six-phase for transmission and to step it down again at the receiving end? The first part of this operation is continuously employed in rotary converters.

There is another point of considerable importance about which I may have something to say at a future date, and that is the fact that I am able to utilize the intersheaths to pass "power" current at a voltage greatly in excess of the voltage employable in even the highest-worked triplex cables.

I appreciate the recognition which Mr. Del Mar has given my investigation by pointing out that under my proposals 150,000 volts can be transmitted with an insulation which would normally correspond to only 45,000 volts.

A. M. TAYLOR.

Erdington, Birmingham, England.

Aberdeen (Wash.) Property Not Sold

To the Editors of the ELECTRICAL WORLD:

Our attention has been called to an article in the ELECTRICAL WORLD of July 14, page 95, captioned "Another Gap to Be Bridged," containing the following: "The company has acquired the light and power system at Aberdeen, Wash., and construction work is in progress to connect Olympia and the Aberdeen plant through Montesano over the Olympia Highway." This is to advise you that the Federal Light & Traction Company is the owner of the Grays Harbor Railway & Light Company at Aberdeen. This property has not been sold and is not in the market.

E. H. LONSDALE,
Secretary to the President.

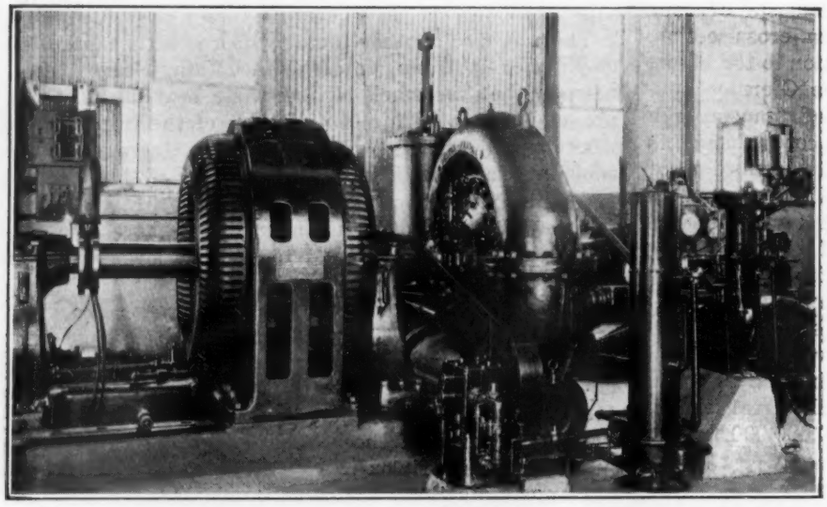
Federal Light & Traction Company,
New York, N. Y.

Central Station and Industrial Practice

Installation, Operation, Maintenance, Test and Repair of Generation and Distribution Equipment, and Methods of Economically Utilizing Electric Service in Large Industrial Plants

Suitable Rubber Seal Rings for Water Turbines

THE design of suitable seal rings for large-capacity, high-head hydraulic turbines presented a new problem when units of this class made their advent, particularly where the water contains silt or other abrasive particles and where, on account of high heads, the water leakage around the turbine runner is more than ordinarily serious. For the past year a large manufacturer of hydraulic turbines has been experimenting with rubber seal rings.



KAWEAH POWER PLANT NO. 2 OF SOUTHERN CALIFORNIA EDISON COMPANY, WHERE USE OF RUBBER SEAL RINGS HAS INCREASED EFFICIENCY

The results have been highly successful, and it is now believed that the seal-ring problem has been solved, thus removing this barrier to the further development of high-speed, large-capacity hydraulic turbines.

In the experiment and study directed toward finding something better in the construction of turbine seal rings the ideal sought was a design and construction which would avoid (1) leakage between stationary and rotating parts, (2) wear between parts, (3) danger of seizure between rotating and stationary parts, or danger that a shutdown might be caused by the assembly of the turbine runner slightly out of the exact center, or even having a slight eccentric movement on account of the necessary clearance within the main steady bearings.

After encouraging results with rubber seal rings, experiments were made to determine the best quality, thickness and hardness for them. Rings now being made embodying the results of these trials are of a thickness that leaves no free clearance between the moving and stationary parts, and the hardness used is about that of a good automobile-tire casing. Under these conditions it is asserted there is absolutely no danger of seizure, no leakage, and the wear after almost a year's operation under adverse conditions has been negligible. The danger of damage to the interior of the turbine from the rubbing of steel rings between the rotating and stationary seal-ring surfaces, is entirely eliminated.

At the Kaweah power house No. 2 of the Southern California Edison Company rubber seal rings have enabled the plant to develop more power under the same hydraulic conditions than ever before and with better operating characteristics. Credit for the success of experiments with rubber seal rings is due Ely C. Hutchinson, general manager and chief engineer of the Pelton Water Wheel Company, who conducted them in cooperation with the author and H. L. Doolittle of the Southern California Edison Company and C. O. Poole and F. O. Dolson of the Southern Sierras Power Company.

H. W. DENNIS,
Construction Engineer,
Southern California Edison Company,
Los Angeles, Cal.

Remote Control of Switches with Few Wires

ON EXTENSIVE transmission systems, especially networks, there are usually advantageous points at which to install sectionalizing circuit breakers which must be opened or closed promptly on certain occasions but where such occasions are not so frequent as to justify a local attendant. For such conditions a remote-control system has been developed by one operating company which it believes will give all the assurance of operating and indicating operations that is had with the usual station-control system. It requires only two wires plus one wire for each switch operated. Furthermore, the wires may be of steel and of any length. No. 8 iron wire is used on several installations involving circuit breakers which are two or three miles from the control station.

In general, the system is only a modification of the ordinary control system used in stations. Two of the control wires are connected with positive and negative control buses at the control station and circuit-breaker installation, the control bus at the circuit-breaker installation being connected to the control storage battery. Charging of the battery is accomplished over the iron wires connecting the control buses by a motor-generator set at the control station. The losses incurred in the iron wire with a charging current of approximately 5 amp. the user believes, will be justified by the advantages of the system.

As shown by the accompanying diagram, there is one additional iron-wire control circuit for each circuit breaker controlled. At the control station this is connected through the control switches and pilot lamps to the positive and negative buses,

while at the circuit-breaker end it is connected through a hesitating relay, closing relay, tripping relay and pallet switch to the positive and negative buses.

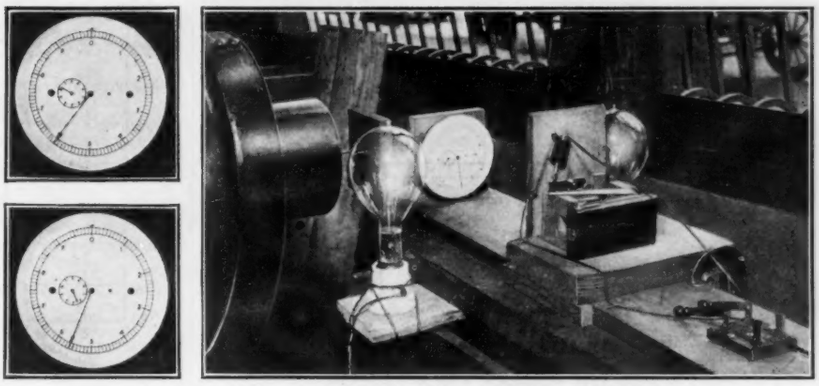
By connecting this wire to the positive or negative buses respectively by means of the control switch the circuit-breaker may be opened or closed. When the operation is performed the pallet switch at the circuit-breaker, which is actuated by the physical operation of the breaker, will connect this control line to the positive or negative bus, thereby lighting the red or green signal lamp as the case may be.

This scheme has made it feasible to install line-sectionalizing switches at strategic points even though they do not justify a local attendant.

There are some disadvantages to the schene, however. For example, if a short circuit should occur on the green lamp it would close the breaker when the breaker is open. If a short circuit should occur on the red lamp when the breaker is closed it would trip the breaker. This could be remedied by providing a resistance of about 350 ohms in each of the lamp circuits.

If the circuit breaker is automatic and equipped with an overload relay the overload relay would have to be connected to the negative and the other side to the common connection with control switch. If there is a dead short during a period when the circuit breaker is open and when it is attempted to close the oil circuit breaker by means of the closing control switch the overload relay would at once attempt to close and cause a short circuit. This would no doubt destroy the relay.

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.



EQUIPMENT FOR PHOTOGRAPHING ILLUMINATED DIALS IN SPEED TEST FOR DETERMINING RETARDATION OF ROTATING MACHINES

Left—Two successive photographs of dials made in a retardation speed test. Right—Camera is used to photograph dial in making retardation speed test on synchronous motor. The test was made by the Oregon company on a 1,060-hp., 400-r.p.m., 33⅓-cycle, three-phase, 10,000-volt synchronous motor.

Core Loss by Retardation Method

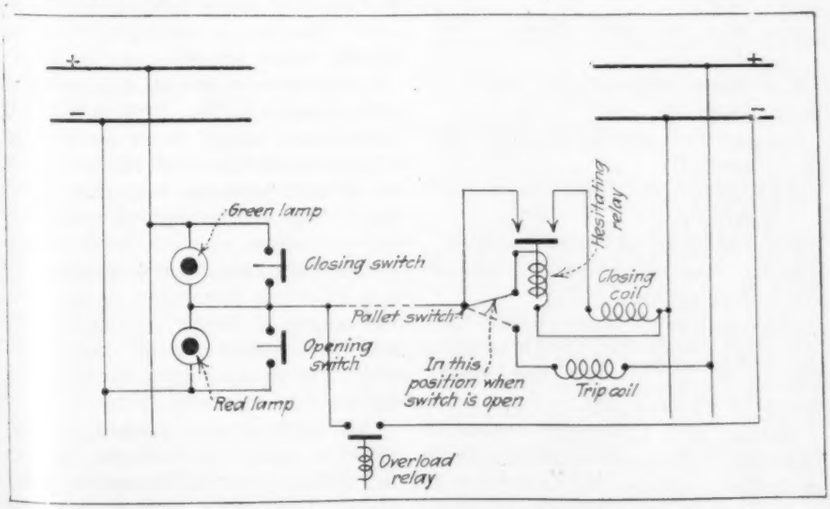
Practical Description of Equipment, Operating Features and Advantages, Followed by Theoretical Analysis

IT IS often found necessary in central-station operation to make efficiency tests on large generators or motors. The determination of friction, windage and core loss is always necessary in making such a test. On the test floor of the factory these losses are measured by the motor-drive method. Out in the plant, however, the motor-drive method can seldom be used for lack of a suitable motor and other requirements. In such places the retardation method for determining losses is more often used and has proved very satisfactory.

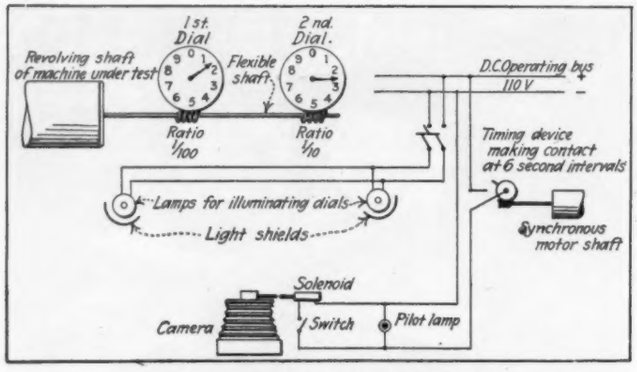
The accompanying illustration shows an unusual photographic method devised by the writer, for determining the rate of retardation of a rotating machine. This method eliminates the personal equation and the possibility of error when the successive speed readings are taken in the usual way. Ordinarily in such tests one man is required to call time, at regular intervals, one to read a tachometer and another to record the readings. This method has four sources of error, inaccuracy of the tachometer and the mistakes of the observers and the recorder.

The photometric method consists of photographing at regular predetermined intervals two dials the hands of which are connected to the rotating object through reduction gears. The camera is operated at an exposure of about 0.01. The first dial is divided into ten parts and connected to the shaft through a gear ratio of one to one hundred. Therefore ten revolutions of the shaft move the hand on the first dial one division. The second dial is also divided into ten parts, but each part is again divided into ten subdivisions. The hand of this dial is connected to the shaft through a gear ratio of one to ten. It follows, then, that one revolution of the shaft moves the hand of the second dial one main division and one-tenth revolution of the shaft moves the hand one of the subdivisions.

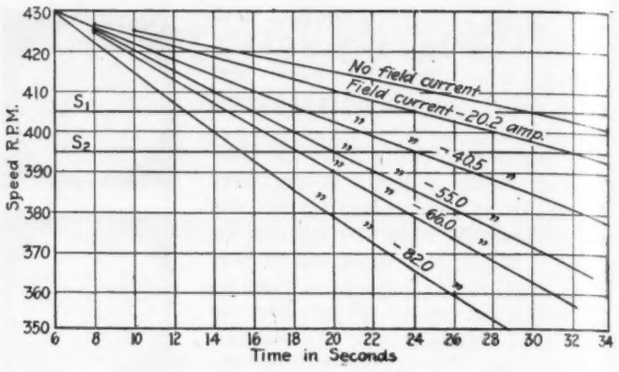
The reading of one exposure is subtracted from the reading of the one immediately following. The difference is the number of revolutions the rotating shaft has made during the time interval selected. If this number be divided by the number of seconds in the interval and multiplied by sixty, the result will be the



SIMPLE CONTROL EQUIPMENT OPERATES OIL SWITCHES AT A DISTANCE



SCHEMATIC DIAGRAM FOR APPARATUS



RETARDATION CURVES PLOTTED FROM DATA

average speed in revolutions per minute of the rotating element. If several successive exposures are taken, the average speed for each succeeding interval can be accurately determined. The data thus obtained should be plotted in the same manner as the speed and the time periods described below in order to get the retardation curves. The camera shutter was operated by a small solenoid which was energized through a contact-making device that closed the circuit every six seconds. This device was attached to a synchronous motor operating on the system. A period of six seconds was selected so that the multiplying constant of the difference between the dial readings would be 60 ÷ 6, or 10. Therefore, if the second dial is read to the nearest subdivision, the difference in the readings of successive exposures will give the average speed in r.p.m. for that period. The general scheme and wiring diagram for the apparatus is shown herewith.

PROCEDURE OUTLINED FOR MAKING PHOTOMETRIC TEST

In making a test the operation is as follows: Place a roll of film in the camera and see that the timing device is working, which will be indicated by the pilot lamp. Bring the machine up to the speed required and then light the large lamps to illuminate the dial. Wait about four seconds after the pilot lamp flashes, then open the source of power to the machine under test and at the same time close the switch in the solenoid circuit. After each click of the solenoid advance the film in the camera for the succeeding exposure. This advance can easily be made in three seconds. An automatic device could be attached, however, to advance the film either by steps or continuously. This scheme eliminates all personal error and gives almost perfect results. Two pictures of the dial taken from a strip of negatives made on a six-exposure film in an actual test on a large synchronous motor are shown.

The determination of core loss by the retardation method consists chiefly in determining the rate of retardation and applying the data obtained in the common energy formulas for moving bodies. First of all the machine to be tested is brought up to a speed higher than normal by means of the local power supply, then disconnected from that supply and allowed to drift down, the speed being read at intervals of five or ten seconds. Several of such observations are taken, including one without field excitation for windage and friction determination and another with definite field current. With field excitation the losses are a combination of windage, friction and core loss. A series of retardation curves can be plotted from the speed-time observations with time as abscissas and r.p.m. as ordinates. Following is a review of the conventional formulas that were used in these tests:

Symbols used in energy formulas:

M = mass.

W = weight.

G = 32.2 ft. per second; then $W = MG$.

V = linear velocity (at radius of gyration).

ω = angular velocity (radians per second).

S = speed in revolutions per minute.

r = radius of gyration in feet.

Wr^2 — moment of inertia in pounds feet square.

Kinetic energy of a moving body $= \frac{1}{2} MV^2 = WV/2G$. With rotating bodies $V = r\omega$ and the kinetic energy $= W(r\omega)^2/2G$.

Application: The energy consumed in retarding from one angular velocity to another—where that is from ω_1 to ω_2—is equal to $(W(r\omega_1)^2)/2G - (W(r\omega_2)^2)/2G = \omega r^2/2G\ (\omega_1^2 - \omega_2^2)$, where $\omega = 2\pi S/60$.

Then the total energy lost $=$

$$\frac{Wr^2}{2G}\left[\left(\frac{\pi S_1}{30}\right)^2 - \left(\frac{\pi S_2}{30}\right)^2\right]$$

$= 0.00017\ Wr^2\ (S_1^2 - S_2^2)$ ft.-lb.

It follows then that the average rate at which energy is lost at a given (normal) speed which is midway between two selected speeds S_1 and S_2 will be equal to the total energy lost divided by the time in seconds required for the revolving element to retard from the speed S_1 to the speed S_2. This time will be represented by $(T_2 - T_1)$. Then E (rate of energy lost) $=$

$$0.00017\ Wr^2\left(\frac{S_1^2 - S_2^2}{T_2 - T_1}\right) \text{ ft.-lb. per sec.}$$

If the loss is expressed in kilowatts:

$$\text{Kw.} = \frac{746}{550 \times 1000} \times 0.00017\ Wr^2 \left(\frac{S_1^2 - S_2^2}{T_2 - T_1}\right) = \frac{2{,}306}{10^{10}} \times \frac{Wr^2\ (S_1^2 - S_2^2)}{T_2 - T_1}.$$

D. W. PROEBSTEL,
Assistant Engineer.
Portland Railway, Light & Power Company,
Portland, Ore.

Corona-Proof Wire Used by Long Island Company

ORDINARY rubber insulation, whether of the code or the 30 per cent Hevea grade, deteriorates rapidly when the wire carries high-voltage current unless it is covered with a lead sheath. This is because conductors raised to a sufficiently high potential are surrounded by an electrical discharge—luminous in the dark if the voltage is high enough—called corona, which takes place whether the conductor is insulated or not. Corona generates ozone from the oxygen in the air, and ozone very rapidly oxidizes rubber insulation, causing it to crack open, especially on the outside of bends.

Although corona discharge takes place at quite low voltages, it does not attain harmful intensity under about 2,000 volts and usually re-

mains invisible up to much higher voltages.

If the rubber-insulated conductor is covered with a lead sheath, either the ozone generated by the corona is kept from contact with the rubber or it does not occur at all, if the sheath is grounded, so that these cables may be used for transmission voltages.

There are some classes of service, however, for which it is desirable to use rubber-insulated, non-leaded conductors for currents at which corona is formed. For instance, the New York & Queens Electric Light & Power Company has a difficult outside distribution problem on account of the number of shade trees in its territory. It is impossible to use weatherproof wire on account of the leakage which would take place in the trees, and it is unsatisfactory to use spans of insulated wire, or tree wire, on account of the damage from chafing against branches. Lead-covered cables suspended from messengers were tried, but these were found to be very unsatisfactory on account of the difficulty of making taps for transformers and branches.

The engineers of the lighting company therefore decided to use on the 2,300/4,000-volt grounded Y system rubber-insulated and braided wires run through rings attached to a messenger. Of course, several wires can be run through a single set of rings, and the ease with which connections can be made to transformers and branches makes this construction economical.

The promising scheme was no sooner put into effect, however, than the rubber-insulated wires began to fail because of the action of corona. Consequently a tree wire insulated with a special rubber compound which is not affected by the ozone from corona was tried. It is covered with a special saturated braid. This wire, which is made by the Kerite Insulated Wire & Cable Company, has been subjected to the most searching tests, which have shown conclusively that it is proof against the destructive effects of corona, and it has given satisfactory service in actual use. A similar cable has been submitted to the New York & Queens Electric Light & Power Company which has withstood its laboratory tests, but none has been in service.

There are other uses to which corona-proof wire can be put, such as the wiring of industrial plants for 2,300 volts or higher.

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.

Cost of Meters in 1922 for New England

DATA from the construction sheets of a New England central-station company are given in the accompanying table covering the cost of various sizes of electric meters purchased and shipped from the factory to the utility stockroom during 1922, but not including the cost of installation. A few current transformers are also in the shipments.

FIELD EDITOR ELECTRICAL WORLD.
Boston, Mass.

METER PRICES FOR A NEW ENGLAND CENTRAL STATION

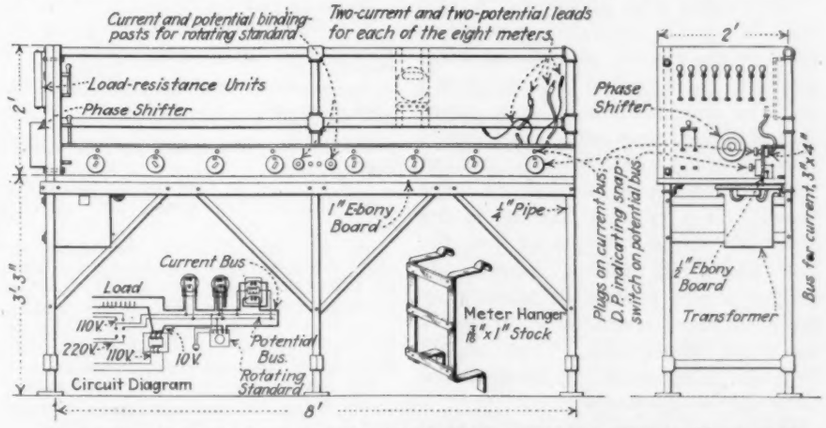
Items	Number of Units	Totals*	Per Unit
5-amp., 110-volt, 60-cycle	3,488	$30,502	$8.75
10-amp., 110-volt, 60-cycle	42	432	10.50
15-amp., 110-volt, 60-cycle	18	229	12.73
150-amp., 110-volt, 60-cycle	1	68	68.00
5-amp., 220-volt, 60-cycle	120	1,084	9.06
10-amp., 220-volt, 60-cycle	40	416	10.40
15-amp., 220-volt, 60-cycle	32	372	11.60
25-amp., 220-volt, 60-cycle	8	114	14.25
50-amp., 220-volt, 60-cycle	6	114	19.00
75-amp., 220-volt, 60-cycle	2	44	22.00
300-amp., 220-volt, 60-cycle	1	91	91.00
5-amp., 550-volt	19	686	36.20
10-amp., 550-volt	10	376	37.60
25-amp., 550-volt	14	583	41.50
50-amp., 550-volt	13	607	46.60
75-amp., 550-volt	2	98	49.00
Potential elements	4	230	57.50
25/125-volt, 8/160-amp. current, transformers	2	374	187.00
3,000-amp. current transformers	2	138	69.00
Freight and express	.....	293	.....

* To nearest dollar.

Building an Inexpensive Meter-Test Board

FOR meter testing the San Antonio (Tex.) Public Service Company built the alternating-current test bench shown herewith for $190, including both labor and material. This figure does not include the cost of the phase shifter, but it does contain the expense of a smaller direct-current board 4 ft. long. This bench for testing two-wire, three-wire and polyphase meters was built to connect eight meters in the circuit with the rotating standard so that after the meters have been tested for light, full and 50 per cent power-factor loads, they can be run until 1 kw.-hr. has been registered on the dials, thus checking the register. All the meters are connected in the circuit, then the current plug is removed and the potential switch turned on the meter to receive the individual tests. After each meter is tested in turn, all the current plugs are removed, the potential switches turned on and the eight meters run simultaneously to check the register.

The bench operates on the phantom-load principle, and to furnish the current a condemned 2-kw. lighting transformer was rewound to transform 110 volts to 10 volts for the current circuit. The potential circuit is on separate buses, and either 110 volts or 220 volts is obtained by means of a double-throw switch. The transformer is hung beneath the top board while the resistance units for the load are mounted back of the switch panel, making the bench entirely self-contained. The ebony-board top is supported on an 2-in. x 2-in. angle iron with $\frac{3}{8}$-in. stud bolts which do not go through to the surface, leaving the top smooth and entirely insulated from the frame.



TEST BOARD FOR TESTING LIGHT METERS EASILY CONSTRUCTED OF 1¼-IN. PIPE

The meters are hung from the frame by means of separate racks which can be shifted when necessary to give room for adjustment. A portable light is suspended from the frame to throw light on the meter. Compressed air was made available for cleaning the meters.

HENRY T. POWELL,
Distribution Department.
San Antonio Public Service Company,
San Antonio, Tex.

Using Barriers During Reconstruction Work

REPLACEMENT of existing equipment without interrupting service often makes it necessary to install temporary switching equipment or requires work to be done in close proximity to live buses and cables. In spite of the many possible bus layouts in temporary switchboards, it is impossible to avoid working in the near vicinity of live equipment, and therefore it is important that guards should be erected wherever there is any likelihood of the operating forces getting in dangerous proximity to it.

These barriers may be built of iron fences or of wood, depending upon the extent of the temporary construction. Inadequately supported guards are very likely to be pushed over into the live equipment with disastrous results. Where the work must be done very close to live conductors, the guard should be made without openings and the men cautioned by signs or otherwise not to bore holes or pass their materials through the guards. Wherever it is necessary to employ carpenters who are inexperienced in working around live equipment, they should be watched continuously by competent electrical men, after being cautioned beforehand as to the dangerous nature of the work.

All cracks and knotholes in this type of barrier should be covered to prevent the chance of pushing wires through them. The lumber going into the construction of each guard should be well seasoned. Care should also be taken that no nails project through the board too close to large buses. This type of barrier is for especially dangerous places, but for less hazardous places, where the danger arises mainly in passing by live equipment, open guards or fences will serve the purpose. These should be made fairly solid but need not be fastened to the floor.

While the wood barriers erected around oil switches, transformers, regulators, busbars, disconnecting switches and the like constitute a considerable fire hazard, it is possible to go too far in guarding for electrical safety, thereby minimizing one hazard by unduly increasing another. Experience and judgment alone will indicate where to draw the line between over guarding and not enough.

N. L. DEVENDORF,
Personnel Department.
Consumers' Power Company,
Jackson, Mich.

Extracts from an Operating Code*

BY FIELD EDITOR ELECTRICAL WORLD
New York, N. Y.

Restoring Interrupted Lines in Generating Stations

REDUCING the time of interruption to a minimum is the most important requirement when outgoing feeders trip in a generating station. This result can be obtained only by correctly analyzing the cause of trouble. Accurate information must be furnished the load dispatcher by the operators of all stations in which disturbances of any kind have been noticed. The first method outlined below will consume more time, but it is safer as any damaged apparatus will be detected before it can cause a repetition of the trouble. This method, however, is not necessary where accurate information has permitted the proper segregation of trouble.

Partial Interruption

Loss of a number of lines, small in comparison to the total number on the bus.

1. Carefully note if any switches have opened automatically and if they have spilled any oil.
2. Report to the load dispatcher. The load dispatcher will order the lines to be tried back or to be given a high-tension test.
3. If the test indicates no trouble, restore service to the lines on order of the load dispatcher.

Total Interruption

Interruption involving all or nearly all of the lines in a station or on one bus.

1. Carefully note if any switches have opened automatically.
2. Clear the bus.
3. Carefully note if the switches which have opened automatically have spilled any oil.
4. Report to the load dispatcher. The load dispatcher will order one of two procedures:

First—(a) Reconnect all lines to the dead bus.

(b) Connect to this bus an alternator operating at full speed but with no field.

(c) Cut in all field resistance and close the generator field break switches, at the same time observing the line ammeters. The current in any undamaged line will be negligible, while defective lines will be indicated by deflection of the ammeter needle.

(d) Disconnect all defective lines.

(e) Bring the voltage up to normal, observing the line ammeters during the process.

(f) Report the results of the test to the load dispatcher and follow his instructions in restoring service.

Second—(a) Energize the bus at normal voltage.

(b) Try back each line in succession, or as many of them as are ordered by the load dispatcher.

(c) Report to the load dispatcher the results of the trial and follow his instructions in restoring service.

*Abstracted from the operating code of the Philadelphia Electric Company.

Making Overspeed Test on Turbo-Generators

AT REGULAR specified intervals tests should be made to determine whether or not the overspeed device in a turbine is in satisfactory operating condition. In testing, the governor should be blocked in some manner, preferably by closing the oil supply to the governor. The machine is then controlled only by the throttle and the speed may be increased above normal as desired. Overspeed tests should be made under the personal supervision of the shift superintendant. Detailed instructions for making the overspeed test follow:

1. Bring the turbine up to speed with field on the generator.
2. See that the machine comes up to normal speed and remains there under control of the governor.
3. Close the throttle, and when the speed of the machine has dropped below normal close the oil-supply line for the hydraulic cylinder of the governor. The machine is now not under control of the governor.
4. Open the throttle and allow the machine to accelerate slowly until the automatic overspeed device operates and note the speed and frequency at which the automatic overspeed device operates.
5. Do not relinquish hand control of the machine until it is certain that the throttle has entirely closed under the action of the automatic overspeed device, as indicated by immediate decrease in speed and in first-stage pressure.
6. After the throttle valve has operated properly under the action of the automatic overspeed device, operate the hand wheel to the closed position and reset the throttle trip.
7. If the automatic overspeed device does not operate, do not allow the turbine to increase in speed more than 12 per cent. Trip the throttle by hand before the speed increases above this limit.
8. At completion of the test open the oil supply line to the governor.

Central Station Business

Advertising, Selling and Service Methods
Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences

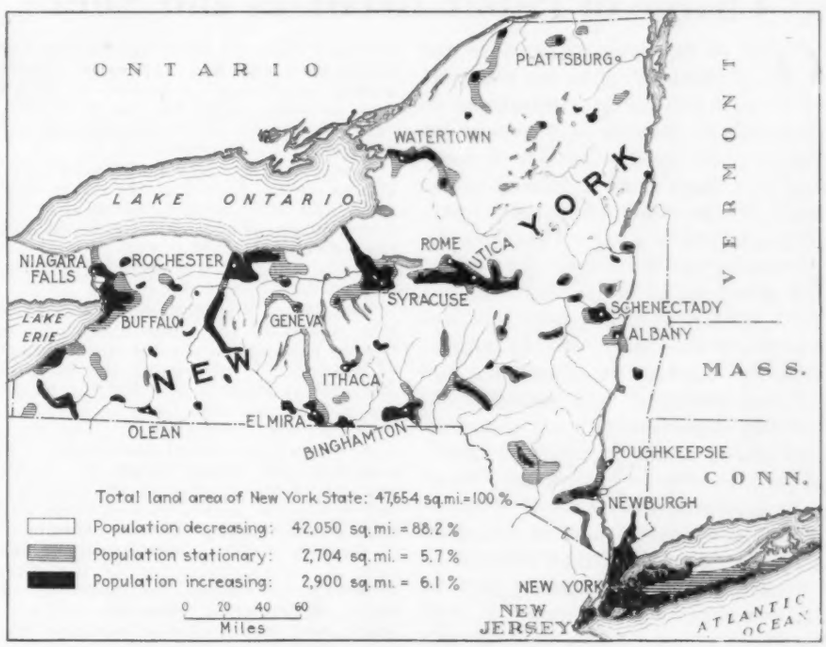
Rural Service as a Help to Stem Cityward Migration

By William M. Carpenter
Engineer Empire State Gas & Electric Association, New York, N. Y.

THE amazing growth of the larger cities at the expense of the rural districts creates a condition of considerable significance to central-station companies. The fact that such a trend has existed has long been commented on, bewailed or rejoiced in according to the personal point of view of the investigator. To the electric plant in the city it means further development and extension; to the distributing company in the country it points out a field, still for the most part untouched, where, with favorable service and an equitable rate structure, the electric industry can be a real benefactor to the country.

The tabular comparison between the figures for the census of 1920 and those for 1910 shows how acute this situation has become in New York State. The trend of the population is graphically shown on the map, upon which the heavily shaded area represents the territory where the population is decreasing, the lightly shaded area that where the population is stationary and the unshaded part that where the population is increasing. With the exception of the vicinity of New York City and the territory immediately east of Rochester, every increase in population represents the results of industrial development. Upon 88 per cent of the area of the state the people are leaving to crowd into the cities, representing only 6 per cent of the total area, and the remaining 6 per cent is barely holding its own. While the map shows the tendencies in 1920, the reports of the Department of Agriculture and of the various farm bureaus all show that the cityward movement has actually accelerated since that date, and as the result of the present limitations upon immigration this tendency may be expected to increase still further.

Unless we are willing to face the possibilities of the recasting of our entire industrial structure, it will soon become the obligation of the community to check to the best of its ability the depletion not only of the rural districts but also of the smaller towns, and to stem in some way the tide of cityward migration. Rural life must be made as attractive as possible, even if it is made so at some expense to the urban communities, and this offers to the electric companies a real opportunity, not only as a matter of duty to the people, but also as an actual business proposition. The dearth of help—of the hired man and or the hired girl—which is one of the principal sources of dissatisfaction with farm life can to a large extent be offset as it has been in the city—by the installation of electrical appliances and by the increased use of electricity. That this has proved to be effective in the villages can be seen from the fact that of the 494 incorporated villages of the state 387 are served by electricity and 107 are not. Of those served, 65 per cent show a gain in inhabitants during the preceding decade and 35 per cent a loss, while of those not so served 86 per cent report a decrease in population and 14 per cent a slight increase.



TREND OF POPULATION IN NEW YORK

Although it does not appear to be either economical or advisable for the farmer to use electric service for larger power purposes (such as

RURAL AND URBAN POPULATION OF NEW YORK STATE—1910 AND 1920

	1910	1920	Change	Per Cent
Cities of more than 10,000 inhabitants	6,771,142	8,103,046	+ 1,331,904	+19.7
Towns of from 2,500 to 10,000 inhabitants	414,352	486,798	+ 72,446	+17.5
Villages of less than 2,500 inhabitants	352,294	346,877	— 5,417	— 1.5
Rural territory	1,575,826	1,448,506	— 127,320	— 8.1
Total—New York State	9,113,614	10,385,227	+ 1,271,613	+14.0

wood sawing, ensilage cutting or feed grinding), where the gasoline tractor can be more advantageously employed, nevertheless there still remains an attractive field for power for pumping, for milking machines and for various small utility motors. In making electricity available for lighting and for household appliances a move of the greatest economic importance is made by bringing into rural territory the comforts and conveniences now available to the city man.

This, however, only can be made possible at prices which, while properly related to the farmers' deflated and still shrinking purse, will at the same time at least allow the electrical distributor to "break even." The ways and means for making extensions into country districts must be developed so as neither to become an unjust burden upon the users of the service nor to entail discrepancies in the charges in the same neighborhood.

During the past year the subject of equitable rates for rural service has received a great deal of attention. It may confidently be hoped that the various agencies now undertaking a study of this problem will soon arrive at an equitable basis for the construction and operation of rural lines and that before long real relief in this manner will be available everywhere for the farm population.

Pacific Gas & Electric Gives Vice-President Charge of Public Relations and Sales

ONE of the most progressive and significant steps in the constructive organization of central-station commercial departments was taken recently by the Pacific Gas & Electric Company, when R. E. Fisher was made vice-president in charge of public relations and sales. These two departments had previously been under the direction of two vice-presidents, F. A. Leach having public relations and Mr. Fisher sales. Mr. Leach was recently made vice-president and general manager, and subsequently the two departments were combined and placed under the direct supervision of one vice-president, Mr. Fisher.

In assuming the duties of this new office Mr. Fisher formed an organization that is of particular interest in its assignment of duties to various departments. The functions and responsibilities of these departments are clearly outlined in the following general order from the office of the vice-president in charge of public relations and sales:

SALES ORDER NO. 1

The assistant to vice-president in charge of public relations and sales, which position is hereby created, will act as general assistant to the vice-president in charge in the handling of all matters for which this department is responsible. He will specialize in the interpretation to division managers of all general orders and rules and regulations of the company, will have charge of informal complaints before the Railroad Commission and will undertake such special assignments as the vice-president in charge may from time to time direct.

Sales Department.—This department will be under the supervision of the sales manager, who will have general control, under the direction of the vice-president in charge, of all matters respecting sales of electrical energy and appliances, gas and appliances, water within municipal boundaries, steam and all other sales not definitely allocated elsewhere. This department will be divided as follows:

Electric Sales: The manager of electric sales will report to the sales manager and will be responsible for the development of methods for increasing the sales of electrical energy and appliances and for the securing of new electric business.

Gas Sales: The manager of gas sales will report to the sales manager and will be responsible for the development of methods for increasing the sales of gas and appliances and for the securing of new gas business.

Commercial Department.—The manager of the commercial department will report to the vice-president in charge and will have charge of the interpretation of rate schedules and rules and regulations relating thereto, adjustment of disputes with consumers and submission of recommendations to the vice-president in charge for approval of such adjustments, renewals of contracts and preparation of contract and sales forms (in conjunction with the law department). He will pass upon the commercial and sales details of all new business estimates and have general control of all commercial details, and in collaboration with the assistant to the vice-president in charge and with the heads of the several departments will co-ordinate the procedure of all departments of this office to promote efficient operation and prompt handling of all business, and undertake such special assignments as may be given him from time to time by the vice-president in charge.

Publicity Department.—The manager of the publicity department will report to the vice-president in charge and will have charge and control of all publicity and advertising in all divisions of the company. He will collaborate with the sales manager in the preparation of all sales publicity and advertising. Division managers will refer to this department for approval any advertisement or publicity which they may desire to place in any publication in their territories.

Bureau of Public Relations.—The manager of the bureau of public relations will collaborate with the manager of sales in the carrying out of the sales service program; he will act as the personal representative of the vice-president in charge in the handling of special adjustments and in contact with organizations and associations, and will undertake such special assignments as may be made by the vice-president in charge.

Is This Weakness Common in Selling Electric Appliances?

THE following story is told and vouched for by the commercial manager of a central-station company having a dozen or more district offices where electric merchandise is displayed and sold. He says that it was an isolated case and does not indicate a general condition, but it does point out that if the central stations are going to profit from this business they must be real merchandisers and employ real salesmen. Here is the story:

Recently Neil C. Hurley of the Hurley Machine Company dropped in to see one of the central-station company's district managers. The manager was out, so Mr. Hurley found a chair near the washing-machine display and sat down to wait for him.

This display consisted of two washing machines and an ironer. It occupied a very prominent place near the door where every one entering or leaving would be sure to see it, but although dozens of people passed in while Mr. Hurley sat there, no one stopped to look at the machines or appeared to be at all interested.

When the manager returned Mr. Hurley found that they had not sold a washing machine for more than two weeks, that in that time they had discovered only two or three live "prospects," and that the only effort they made to get business was through newspaper advertising and the "floor display."

Mr. Hurley then told him of his experience watching the people walk past the floor display and asked him why he did not have his sales force talk washers and ironers to every customer that came in. His point was that, no matter what a woman came into the office for—even if only to pay a lighting bill—her attention should be called to the home laundry machines. In other words, the floor display in itself would not make the sales; it was necessary for the company to get the value out of that

floor space by bringing its customers over to the machines and giving them a little demonstration and sales talk.

The result of the conversation was a meeting of the office employees at which the entire matter was thoroughly covered, and each man and woman was instructed to keep a careful record of the people who were interested so that they could be followed up.

The plan went into effect the next morning, and when a check-up was made at the close of business that day it was found that two washers and one ironer had been sold and that they had obtained six live "prospects" for washers and four for ironers.

The point of the story is obvious. A display in itself, no matter how good it may be, will not make sales. To make the sales and get the live leads which can be developed into sales by proper "follow-up" methods, the customers' attention must be called to the appliances on display.

Progress of Customer-Ownership in Last Eight Years

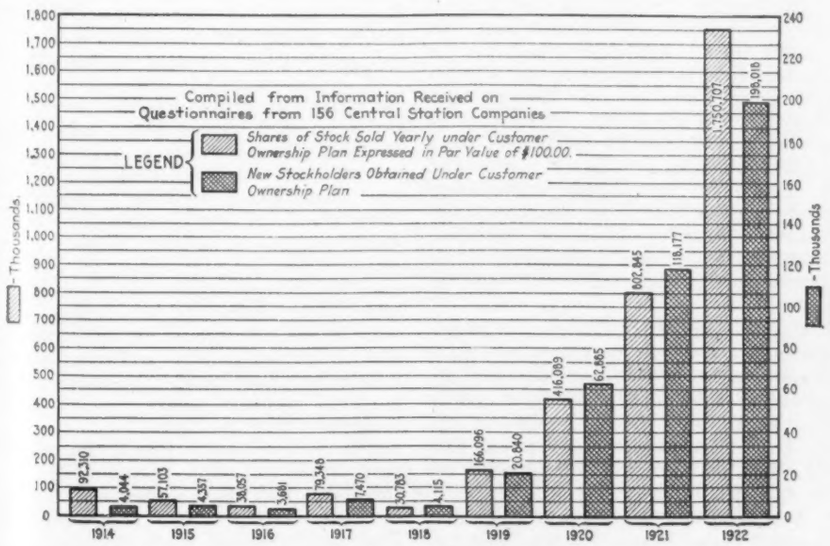
DATA compiled by the customer-ownership committee of the National Electric Light Association from answers to 156 questionnaires received from central-station companies indicate the phenomenal progress in the movement to make the customer a partner in the utility business. The accompanying diagram shows graphically the yearly number of shares, expressed in $100 par value, that have been sold to customers from 1914 to 1922. It also shows the number of new stockholders obtained under the plan durin the same period. A summary of the data showing the total population served, number of customers and customer-owners, the average cost of selling per share and so on is given in the accompanying tabulation.

The value of customer ownership to the industry becomes fully apparent when it is remembered that state ownership of the water powers in California was recently defeated by a vote of 700,000 against and only a little more than 200,000 in its favor. That state had 100,000 customer stockholders, each of whom was believed to control seven voters who favored the utilities.

SUMMARY OF INFORMATION FROM 156 ELECTRIC LIGHT AND POWER COMPANIES

Total population of territory served	40,899,096
Total number of customers.	7,698,313
Gross earnings of combined companies reporting	$555,553,901.47
New stockholders obtained from customer-ownership plan	426,495
Shares of stock sold under customer-ownership plan (stated. in par value of $100 per share)	3,449,185
Percentage of sales on deferred-payment plan (average)	32.5
Percentage of stockholders obtained through customer-ownership plan, to customers	5.5
*Average cost of selling per share as reported by seventy-five companies	$4.39
Ratio of stockholders to population	1.95
Shares sold to customers, 780,438; employees, 150,-511; others, 125,491 (only fifty-eight companies reported on this item).	

*In report of average cost of selling, the lowest was 5 cents per share, which included postage and printing circular letter. The largest amount was $9.64 per share, including commission, advertising, transportation, general office expenses and salaries.



SHARES OF STOCK SOLD AND SHAREHOLDERS OBTAINED YEARLY UNDER CUSTOMER-OWNERSHIP PLANS

What Other Companies Are Doing

Bennington, Vt. — The physics class of the local high school recently received instructions regarding electric meters. A representative of the Twin State Gas & Electric Company explained the construction and operation of meters and showed how they are read and the monthly bills determined. Some testing instruments were loaned to the school, and during its study of electricity the cost of operation of different appliances was calculated.

Wisconsin. — Elgin Club, on Geneva Lake, is endeavoring to have all of its summer residents use electricity for cooking and water heating, thus eliminating fire hazards. Electric service is furnished by the Southern Wisconsin Electric Company.

Rockland, N. Y. — In two and a half months the sales crews of the appliance department of the Rockland Light & Power Company have sold more than $20,000 worth of appliances. Vacuum cleaners have been installed in 260 homes, and in doing this a record has been made for cleaner sales in New York State, according to Cyrus Barnes, general sales manager of Charles H. Tenney & Company, Boston, Mass., operators of this property. One hundred dollars in bonuses and prizes have been distributed among these outside men. T. Scott Saylor is sales manager of the Rockland company.

Anderson, Ind. — The Traction Light & Power Company is now merchandising electrical appliances through the services of a salesman who travels between the various towns on the traction system. He carries several grips of appliances, including toasters, curling irons, grills and so forth, some of which he leaves at the interurban stations as a display. The remaining appliances he uses for a house-to-house campaign. By means of the interurban service, any of the larger appliances, such as a washing machine or vacuum cleaner, can be delivered from the main office within four hours whenever a group of prospective customers desires an actual demonstration of such an appliance. After the salesman leaves that territory the local agent handles the other calls.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
from All Parts of the World

Hydro-Electric Development and Steam Equipment

Municipal Power Plant at Lansing, Mich.—O. E. BULKELEY.—This plant, operated by a board of commissioners, has an initial installation of 25,000 kw., with an ultimate capacity of not less than 40,000 kw. Following are some of the interesting features of the plant: Steam supplied to turbines at 275 lb. pressure and 200 deg. superheat, six 15,000-sq.ft. V-type boilers each fired by sixteen retort underfeed stokers, forced draft supplied by independent motor-driven fans, centralized boiler-control system, heat balance maintained by house turbines and steam extraction, evaporators for distillation of feed-water make-up and the location of all steam and other headers below the operating floor. The plant is designed for maximum accessibility and daylight illumination.—*Power*, June 19, 1923.

The Manchester (England) Electricity Supply.—The New Barton generating station of the Corporation of Manchester contains three 27,500-kw. turbo-alternators, each capable of a maximum output of 31,200 kw. for short periods. The operating steam pressure of the main sets is 350 lb., the temperature 700 deg. F. and the speed 1,500 r.p.m., with a vacuum of 29.1 in. at full load and a 30-in. barometer. The station auxiliary supply, control room, switch house, boiler room and coal-handling facilities are discussed in detail.—*Electrical Review (England)*, June 22, 1923.

Furnace Construction for Power Stations.—O. K. LIENTZ.—The author discusses the problems to be met in modern furnace design, factors to be considered in the design of a furnace and actual tests.—*National Engineer*, July, 1923.

Generation, Control, Switching and Protection

Overvoltages, Overloads and Conditions of Effective Resonance in the Practical Use of the Petersen Reactor.—A. INCONTRI.—The author, after treating mathematically with many numerical examples overvoltages, overloads and conditions of effective resonance in the Petersen reactor, draws the following conclusions: The Petersen reactor—very good in its theoretical simplicity—is not diminished in value when practically applied. It is necessary only to figure out with great care the value of the normal capacity of each wire to ground. The dissonance of the reactor is automatic, so that a previous determination of it is not necessary. While designing a reactor it is of great importance to take into account the reactances of the transformers and of the transmission line. Finally, the author believes that owing to the continuous growth of the transmission installations, and consequently of the quantity of energy which can freely circulate through the short circuits, it is not unsafe to foresee a limit beyond which the Petersen reactor, properly proportioned, will become indispensable. — *Elettrotecnica*, June 15, 1923.

Water Resistances.—H. MAN.—For testing generators in the field or at the manufacturers' very frequently a water resistance is used to dispose of electric power. In a large container of wood or cement a stationary and a movable metal plate are inserted, which form electrodes between which the water acts as an ohmic resistance. The paper gives valuable hints as to the best arrangement of such resistors and tabulates dimensions and data for twelve different water boxes with a capacity of from 900 kw. to 21,000 kw. A current density of 11 amp. per square decimeter should not be exceeded because the water temperature should stay below 70 deg. C. Above this temperature the water becomes disturbed, resulting in an unsteady resistance. The specific resistance of the water used has a very great influence upon the electrode size and distance.—*A. E. G. Mitteilungen*, June, 1923.

Transmission, Substations and Distribution

Tacoma-Seattle Power Exchange Line. — R. E. TOWNE. — An interesting and valuable application of the large-capacity regulating transformer will be made shortly. It will be placed in service in the Pacific Northwest and will constitute an important link in the transmission tie line joining the municipal power systems of Tacoma and Seattle. The apparatus will be used to connect a 57,000-volt Y system to a 50,000-volt delta system. It consists of a 15,000-kva. three-phase transformer with taps by means of which, in conjunction with an induction regulator, large variations can be obtained in the transformer ratio. — *Electric Journal*, June, 1923.

Experimental Determination of Short-Circuit Currents in Electric Power Networks.—O. R. SCHURIG.—An abstract of this paper may be found in the ELECTRICAL WORLD report of the A. I. E. E. midwinter convention, Feb. 24, 1923, on page 438.—*Journal of the A. I. E. E.*, June, 1923.

Summary of High-Tension Underground Transmission Practice and Development.—G. B. SHANKLIN.—After discussing the advancement made in the art and giving data concerning three-conductor and single-conductor cables installed in America, the author compares the development with that in Europe. He then compares the relative merits of three-conductor and single-conductor cables and discusses joints, dielectric strength, internal ionization in the table and heating of cables of various types and cross-section.—*General Electric Review*, July, 1923.

Units, Measurements and Instruments

Optical Methods for Measuring Oil Film in Bearings. — V. VIEWEG. — The use of a suitable lubricant in its bearings is of vital importance to the performance and the economical operation of a rotating machine. At standstill the metal of the shaft touches directly the metal of the bearing. During the starting period the shaft is rolled slightly upward and forward and has a more or less pronounced unsteady radial motion. The exact determination of the position of the shaft in relation to the bearing during the start and the run of a machine is therefore a very essential means by which to judge the suitability of a lubricant or to compare two different oils. Both methods described by the author can be used in the field and neither is a strict laboratory measurement. Both give results with an accuracy of within 0.00004 in. The first method is suitable only for end bearings and measures the displacement of a point on the center of the shaft with a microscope. The second method, suitable for any part of the shaft, measures by means of optical aberration the rise or fall of the shaft and records the amount of it upon a slowly moved photographic plate. The paper should be of considerable interest to manufacturers of electric machines and oil refiners.—*Wissenschaftliche Abhandlungen der Physikalisch-Technischen Reichsanstalt*, Vol. VI, No. 2, 1923.

Transformer Testing Equipment.—E. LIENHARD.—A modern transformer testing department is described in detail. Provisions are made to test small and large capacity transformers of the self-cooled, water-cooled or air-blast types, a dark room is available for corona observations, and a special high-potential and impulse-voltage apparatus are installed. A total generator capacity of 725 kva., comprising three machines, and in addition feeders supplying 1,500 kva. at 16⅔ to 50 cycles, give the necessary testing power. A large high-voltage and low-voltage line selector permits supplying any desired testing current to any particular place within the department. Of interest are portable testing tables, which are brought next to the tested machine, and which contain, ready wired, the necessary apparatus and instruments for the usual iron loss, copper loss, ratio, impedance, etc., tests on transformers. The high-potential room contains one transformer for 225,000 volts and one for 500,000 volts. A 500-mm. sphere

spark gap measures the breakdown voltage. A large oil basin is let into the floor of the high-potential room, in which core and coils of the tested transformer or high-voltage leads are immersed during the test.—*Brown-Boveri Mitteilungen*, June and July, 1923.

Illumination

Lighting Art Galleries. — A. L. POWELL, A. S. TURNER and H. A. COOK. —The layout, with a general description, of the simulated daylight illumination of the Grand Central Art Gallery, New York City, is explained in this article. Care was taken to provide a system of lighting that would present the art subjects just as the artist conceived them. Elimination of shadows, clarity of intricate detail and apparent absence of the feeling of light are the features of this lighting system.—*Electrical Record*, July, 1923.

Motors and Control

Electric Drive for Sectional Paper Machines.—O. C. CORDES.—The necessity for using the same machine for various grades of paper, together with the inherent characteristics of the manufacture of paper, produces three fundamental requirements for the control of these motors, namely: The relative speeds of the motors for any given adjustment must be constant, the relative speeds must be adjustable over a small range, and the speeds of all the motors must be adjustable simultaneously over a wide range without affecting the relative speeds. A control system is described in which the first requirement is met by the use of a master rotary contactor in conjunction with a rotary contactor on each section. The second requirement is met by a speed changer between each section rotary contactor and the motor whose speed it regulates, and the third by adjusting the voltage impressed on all the section motors and the motor driving the master rotary contactor. A very detailed description of the control system is given. — *Electric Journal*, July, 1923.

Winding Induction Motors.—A. M. DUDLEY.—The author tells what distribution and chord factors are and how they are derived in the application of winding stators of induction motors. —*Industrial Engineer*, July, 1923.

Heat Applications and Material Handling

Electric Heating.—E. ZUELEMANN.—A paper giving a survey of modern uses of electric power for industrial heating purposes, dealing in a general descriptive way with a great variety of such devices in connection with which electric generation of heat has been introduced to advantage. Particularly wherever surplus hydro-electric power is available, electric heating results in coal saving, which is of great economic value. Electric steam boilers and hot-water house-heating plants have been developed during the last few years to great perfection. Electric heating units supersede gas and steam on presses and rollers. Welding machines, rivet heaters and forging presses have been successfully electrified. Electric furnaces are so widely used today and are of such varied design that they are only mentioned. Very recently electrically heated driers have been introduced in textile mills.—*Zeitschrift des Vereines Deutscher Ingenieure*, June 23, 1923.

Material-Handling Facilities.—G. A. VAN BRUNT.—The material-handling scheme that forms an integral part of production processes is an important factor in securing continuous maximum output at minimum cost. The author describes the layout that controls the flow of production in the works of the Bates Expanded Steel Truss Company. A material-handling plant based on the use of electric hoists, chain conveyors and rollers, was devised before the production equipment was put in place. —*Industrial Engineer*, July, 1923.

Electrophysics, Electrochemistry and Batteries

Improvement in Electrolytic Silver Refining.—A. H. W. CLEAVE.—A circular electrolytic cell for refining silver is described which is 36 in. in diameter and which rotates at a peripheral speed of 40 ft. per minute. The current density varies from 75 amp. to 150 amp. per square foot. The electrolyte is placed in the annular space between the outer and inner walls of the cell. By means of a specially designed cathode and multiple grouping of the anodes, the current causes the deposited silver to adhere loosely to the cathode, so that it may be easily removed. The cell is capable of an output of 40.3 ounces per hour or more than twice as much as the older type of cells.—*Engineering and Mining Journal-Press*, July 7, 1923.

Storage Battery Cars on the Canadian National.—E. B. WALKER. — Five storage-battery cars have been used on the Canadian railways between Trenton, Ont., and Belleville with marked success. Power used is from but 2½ kw.-hr. to 3 kw.-hr. per car-mile (30-ton car) at the alternating-current side of the charging set. The company has found that the nickel-iron battery stands the rough usage and gives longer life in battery-car service than does the lead battery. However, the longer life of the nickel-iron battery is partially offset by the lower price and high efficiency of the lead battery.—*Railway Electrical Engineer*, June, 1923.

Traction

Austrian Express Locomotives. — B. V. NES.—Two of the new Austrian express locomotives for the mountainous Tyrolean branch are now in operation and five more are expected to be delivered within the next ten months. The engines are for 15,000-volt, single-phase, 16⅔-cycle current and are of the class 1-C + C-1. In a main transformer of 1,730 kva. output, equipped with eighteen taps of about 70 volts each, a special double-brush step switch permits a sparkless increase of the motor voltage from zero to a maximum of 1,330 volts. The transformer is oil-cooled with cooling coils arranged on the outside of the engine cab. The main oil switch has a ten-point break and two initial resistance contacts. Its rupturing capacity is given as over 100,000 kva. A total absence of contractors and straight-resistance braking are the two main reasons for the exceedingly simple, positive and reliable control mechanism of this locomotive. Four twelve-pole compensated series motors, with resistance connections between armature winding and commutator, each of an hour rating of 441 kw. at 640 r.p.m., drive in couples two blind shafts, which in turn are connected with horizontal rods to three drivers each. The motors are designed for 530 volts each, operated two in series. They are forced-air-cooled, with the air passing a special filter before being blown through the windings. This has greatly reduced the insulating difficulties, as an analysis of the incoming dust-laden air has shown that the solid impurities consist of 52 per cent iron, 10 per cent carbon and 4½ per cent copper. Two large pantograph current collectors for the open road and two small collectors for the tunnels have been provided on the engine roof. An elaborate electro-pneumatic interlocking system prevents access to any high-voltage apparatus as long as it is alive. Compressor motors, vacuum-pump motors and train-heating devices are all served from the transformer.—*Elektrotechnik und Maschinenbau*, June 24, 1923.

Electric Braking as Applied to Mine Locomotives. — E. J. GEALY. — The author describes the application of electric braking controller to mine locomotives. The greatest field is for the gathering type of locomotive. The transposition from motors to generators is explained.—*Coal Age*, July 5, 1923.

Telegraphy, Telephony, Radio and Signals

Electric Oscillation in Three-Phase Overhead Distribution Lines.—S. BEKKU.—Experiments with electromagnetically induced electromotive force on a communication line by a neighboring power line with ground return show that the coefficient of mutual induction is far greater than the value calculated by the principle of electric image. The author has developed a theory without the assumption of the proportionality of coefficient of mutual induction. He does not consider the potential difference along the earth's surface, which is somewhat contradictory to the supposition of finite conductivity of earth crust. In this respect the theory developed is to a certain extent semi-empirical, and its validity must be checked with the experimental results performed on the actual transmission line. — *Research Publication No. 120 of the Electrotechnical Laboratory, Tokyo, Japan.*

New Books

Reviews of the Latest Contributions to
Technical, Industrial and Commercial Literature of Particular Interest
to Members of the Electrical Industry

Radio—Télégraphie, Téléphonie, Concert

By E. Reynaud-Bonin. Paris: Gauthier-Villars et Cie. 176 pages, illustrated.

This 176-page pamphlet is a sort of glorified index of the subject. The author has selected too much subject matter to be covered in pamphlet form and has sacrificed clearness to brevity in order to make it all-inclusive. Much of the matter is presented in outline form, almost as if whole chapters of a complete text on radio had been condensed to a few pages. This criticism applies to other books that have recently appeared. They do not give the reader a clearer insight into or a better understanding of the subject.

The preface dedicates the pamphlet to the amateur, but the amateur who can read it with understanding does not need to. The first chapter is brief and historical, an arbitrary collection of names and dates of little value. Further on general statements are made which are true only under certain conditions. The conditions are not generally stated.

The discussion on receiver circuits, detectors and amplifiers is very good. The circuit diagrams of vacuum-tube sets are unnecessarily awkward. It is unlikely that an amateur will understand the operation of the circuit shown in Fig. 65 from the explanation on page 86. Pages 100 to 110 cover briefly the service channels in France and her colonies and are of interest to the French amateurs. This matter is well presented. The chapter on the theory and practice of radio telephony will not be readily understood by beginners. In a "Conclusion" the author generalizes on the present and future usefulness and possibilities of radio.

H. M. TURNER.

The Engineering Index

Volume 21. By the American Society of Mechanical Engineers. New York: J. J. Little & Ives Company. 675 pages.

Approximately thirteen hundred periodicals, reports and other publications regularly received during the year by the Engineering Society, New York, have been reviewed for the purposes of this volume, and from six hundred of these the articles to be indexed have been selected. About 20 per cent of these periodicals are printed in Great Britain and her possessions and approximately 30 per cent are representative publications of Belgium, France, Germany, Italy, Spain, South America and other foreign countries.

The book indexes not only the 1922 periodicals received during the calendar year, but also 1921 publications which came in too late to be reviewed in the 1921 index and all late 1922 publications received previous to February, 1923. The book contains a larger number of references than ever before, but by virtue of conciseness its size has not been unduly increased.

Photostatic copies of articles indexed may be secured from the Engineering Society Library, 29 West Thirty-ninth Street, New York, at a charge of approximately 25 cents per page.

The Electrical Handling of Materials

Vol. IV. Machinery and Methods. By H. H. Broughton. London: Benn Bros., Ltd. 315 pages, illustrated.

A comprehensive volume on electrical and mechanical equipment for handling materials economically. Many examples are culled from practice throughout the world to illustrate the status of the art. Elevators and conveyors, belt conveyors, automatic feeders, skip hoists, bulk materials, grain handling, the handling and storage of coal, ore and similar materials, and the handling of foodstuffs and general merchandise are treated in chapters which are detailed, thorough and well illustrated. The book is a real handbook on material handling and is well edited and printed. Costs and installation details add to its value, and there seem to be no gaps in the descriptions of existing apparatus or methods in this line of activity.

German, British and American Standards Compared

By Friedrich Nettel. Berlin: Julius Springer.

This pamphlet of forty-two pages gives a concise and accurate comparison of the more important standards of Germany, Great Britain and the United States relating to rotating machines (except railway motors) and transformers. It is printed in English. The standards compared are the following:

Germany—V. D. E. 1923 Rules.

Great Britain—(1) British Engineering Standards Committee, (a) No. 72, 1917; (b) No. 168, 1923 (Industrial Motors). (2) Beama Rules, 1920.

U. S. A.—1922 Standards A. I. E. E.

The statement of U. S. A. standards is misleading in a few instances because only A. I. E. E. standards have been included. Standard machine and transformer voltages, for example, adopted by the N. E. L. A. and Power Club are not referred to and it would appear that the United States has no standard voltages.

The subject matter of the several standards has been necessarily condensed, but considering the small size of the publication the contents are surprisingly complete. The rules of the three countries are arranged side by side in parallel columns so that comparisons can be very readily made. This compilation should be of interest and value to engineers interested in the preparation of standards and to the much larger group interested in the sale of electrical machinery and transformers abroad. F. D. NEWBURY.

Atoms

By Jean Perrin. Translated by Hammick. New York: D. Van Nostrand Company. 225 pages.

Those who are interested in the semi-speculative realms of atomic structure will find this book valuable. It is notable for its good style and for the clear explanations of the phenomena described. The layman can read it with intelligence and the specialist with profit. It deals with chemistry and the atomic theory, molecular agitation, emulsions, Brownian movements, fluctuations, light and quanta, the atom of electricity and the genesis and destruction of atoms.

Inductive and intuitive reasoners are working on the details of the doctrine of atomic structure, and the tendency is toward the theory that all matter is infinitely discontinuous with a continuous ether. A fluid in equilibrium is merely an illusion and a snare for the unwise. The quanta open new vistas for applying Planck and Einstein conceptions to the universe about us, and the author outlines many methods of application. The book is well printed and should be well received.

Books Received

A Symbol of Safety. By Harry Chase Brearley. New York: Doubleday, Page & Company. 290 pages, illustrated.

Ausgleichsrechnung. By V. Happach. Leipzig and Berlin: B. G. Zeubner. 74 pages, illustrated.

Absolute Measurements in Electricity and Magnetism. By Andrew Gray. London: Macmillan & Company, Ltd. 837 pages, illustrated.

A Manual of Artificial Respiration. By Capt. G. R. G. Fisher. Boston: The Stratford Company. 80 pages, illustrated.

The Electric Furnace for Iron and Steel. By Alfred Stansfield. New York: McGraw-Hill Book Company, Inc. 453 pages, illustrated.

Wissenschaftliche Abhandlungen der Physikalisch-Technischen Reichsanstalt. By fourteen authors. Berlin: Julius Springer. 124 pages, illustrated.

L'Eclairage. By E. Darmois. Paris: Gauthier-Villars et Cie. 276 pages, illustrated.

Radiotélégraphie et Radiotéléphonie. By G. Malgorn. Paris: Gauthier-Villars et Cie. 227 pages, illustrated.

Grundzüge der Starkstromtechnik für Unterricht und Praxis. By Dr.-Ing. K. Hoerner. Berlin: Julius Springer. 257 pages, illustrated.

News of the Industry

Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men

Plans for World Power Conference

Water-Power Development and the Application of Power to Industry to Be Considered Internationally in London Next Year—Twelve Countries Already Co-operating

THE world power conference which is scheduled to be held in London next year under the presidency of the Earl of Derby is fast taking form. National committees have already been organized in Canada, France, Italy, Belgium, Switzerland, Norway, Sweden, Holland, Denmark, Poland, Czechoslovakia and the United States, and the chairman of the Canadian committee, J. B. Challies, and the chairman of the committee from the United States, O. C. Merrill, are expected to arrive in London early in August to help map out the program.

In view of the fact that many of the delegates attending the conference will be interested primarily in water power, the central organization in London has formed a special section devoted to water power, with its own secretary and advisory sub-committee. The secretary of the water-power section is C. M. Norrie.

The program thus far outlined with regard to water power provides for national reviews of the water-power situation in all of the great water-power countries of the world. In these reviews will be treated the attitude of governments toward water-power development, with a summary of legislative policy affecting state control and private enterprise. In addition it is planned to give a historical review of the progressive utilization of water-power resources, statistical data on powers developed and undeveloped, questions of finance, potentialities of water power with reference to national welfare and the productive possibilities of the future.

Many Papers to Be Prepared

Technical papers have been solicited covering generating conditions and economy, recent practice in the design and layout of the civil engineering features of water-power schemes, and recent practice in the design, manufacture and operation of hydraulic pipe lines, machinery and electrical equipment. In the transmission and distribution of hydro-electric energy papers will be provided covering the general economic principles, recent practice in the design and operation of transformers and switches, high-tension lines and distribution systems for rural and industrial districts, and the application of hydro-electric energy, particularly with reference to systems of administration and to industrial and transportation service.

It is the intention that all papers shall be printed and circulated well in advance of the date of the conference so as to obtain the maximum amount of discussion of them. The council of the British Electrical and Allied Manufacturers' Association in arranging the final program is said to have the co-operation of the Admiralty, the War Office, the Air Ministry, the Department of Scientific and Industrial Research, the National Physical Laboratory, the Institution of Civil Engineers, the Institution of Mechanical Engineers, the Institution of Electrical Engineers, the Society of Chemical Industry, the Federation of British Industries, the Cable Makers' Association, the British Engineers' Association, the British Empire Producers' Organization, the Industrial Fatigue Research Board and other British bodies.

Henry Ford to Electrify His D., T. & I. Railroad

It has just been announced that contracts aggregating $1,000,000 have been awarded to the Westinghouse Electric & Manufacturing Company for the construction of electrical equipment, including locomotives, for the Detroit, Toledo & Ironton, Henry Ford's railroad. Preparation for the electrification of the first unit of the line is under way.

New equipment at the River Rouge power house will furnish the motive power for this unit. At this power house the original capacity is being doubled. The present generating system, consisting of two 12,500-kva. turbo-generators, is being replaced by eight turbo-generators each rated at 30,000 kva. The steel work on three of the stacks is completed, and one of the turbines is near completion. A voltage of 22,000, single-phase, will be carried on the trolley with a transmission voltage of 150,000.

Besides this addition at the River Rouge plant, the new plan calls for the building of locomotives, the construction of 13½ miles of double track between the River Rouge plant and the Flat Rock yards, and many minor changes.

The new electric locomotives for the Detroit, Toledo & Ironton for freight service will weigh 360 tons. They will have a normal capacity of 4,000 hp. and will be capable of producing 5,000 hp. for an hour. They will have sixteen driving axles and will develop 108,000 lb. drawbar pull at 25 miles an hour. Their maximum speed will be 45 miles an hour.

Philadelphia and Camden Are Interconnected Electrically

Difficult engineering obstacles were surmounted in almost record-breaking time by the Public Service Production Company in connecting the Philadelphia Electric Company's Delaware station with the Public Service Electric Company's system in Camden, N. J., to assure a substantial electric auxiliary service in the southern part of New Jersey. The job was completed in eight weeks and the line is now in operation.

The work necessitated the laying of three cables under the Delaware River. Two of these are 350,000-circ.mil cables and extend from the Delaware station of the Philadelphia company to the Atlantic Avenue substation of Public Service company. Each has a capacity of 12,000 kva. and is 16,600 ft. long. The third cable is of smaller dimensions.

Permission from the government to install the cables was contingent on the digging of a trench, 5 ft. to 15 ft. deep, in the riverbed, in which the cables were laid. In the channel this trench is 45 ft. below mean water level. The cables were mounted on barges, and each represented three wound reels.

Wyoming Legislature Passes Bill on Water Rights

At a special session of the Wyoming State Legislature during the month of July the House and Senate passed unanimously a bill concerning "water rights" which is approved by Governor Ross, the bill being in line with the Governor's wishes and one of the reasons for the calling of a special session of the lawmakers.

Claiming that Wyoming is the "watershed of the continent," that rivers originating in Wyoming find their way to the Gulf of Mexico, Gulf of California and Puget Sound, the law thus enacted instructs the Governor

of Wyoming to communicate to the Governors of the other interested states and to the federal government Wyoming's proposal for the creation of a state and federal water commission. The commission would consist of representatives of all the states involved and a representative of the United States. The commission would have authority to enter into agreements concerning the waters of all streams rising in the State of Wyoming and draw up a treaty definitely settling all disputes for all time.

Commission Engineers Against Louisville

Give Preference to Central-Station Company's Application in Falls of Ohio Conflict—Property Owners Enjoin Dothan (Ala.) Project—Pigeon River Development

AS FORESHADOWED in the ELECTRICAL WORLD, a recommendation will be submitted to the Federal Power Commission by its engineering staff that the application of the city of Louisville for a preliminary permit to develop a hydro-electric project on the Ohio River near that city be disapproved and that the application of the Louisville Hydro-Electric Company, a Byllesby subsidiary, covering the same site be granted. The conflicting applications regarding this proposed development have been before the commission a little more than a year. A letter setting forth the views of the staff has been sent the city officials and a copy directed to the company. Under the procedure of the commission the city will have a month to make reply before the recommendation is placed formally before the commission.

In their letter the members of the engineering staff set forth that the project cannot be developed except with auxiliary power of approximately equivalent capacity, 75,000 hp. to 100,000 hp., and that the Louisville Gas & Electric Company now has its steam development to serve that purpose, while the city's proposal to develop auxiliary power on the Green River would be an unjustifiable duplication of facilities for which the consumer would have to pay. It is further contended that for reasons of economy the hydro-electric plant and the steam plant should be controlled and operated by the same concern.

If the city were able and willing to take over the properties of the Louisville Gas & Electric Company, including its distribution system, then it would be clearly entitled to the preference for municipalities set forth in the water-power act. To build a hydro-electric plant and take over the properties of the private company would involve $25,000,000 to $30,000,000 and for the city to get authority to bond itself to this extent it would be necessary first to obtain an amendment to the constitution of the State of Kentucky, with consequent great delay even if this could be accomplished.

It is further asserted by the engineers that the power project is feasible only as an adjunct to navigation development in the Ohio River and that this navigation development must be started within the next year, since it is part of the remaining gap in the provision of 9-ft. navigation in the Ohio from Pittsburgh down. Speed in settling the question, therefore, is essential so that the permittee can work out with the War Department the best project for power and navigation at the proposed site.

The city has the legal authority to regulate rates and therefore can protect itself, the commission's engineers further point out. The proposed hydro-electric development amounts to only 20 per cent of the properties of the existing power company, and whenever the city is able and ready to condemn and take over these other properties, it can also condemn and take over the hydro-electric development. The rejection of the city's application does not therefore deprive the municipality of the right to go into the power business whenever it is ready to do so.

CHOCTAWHATCHEE PROJECT ENJOINED

A preliminary injunction has, on the petition of property owners, been issued to prevent the city of Dothan, Ala., from proceeding with construction of a proposed power dam in the Choctawhatchee River for which a license was issued by the Federal Power Commission in August, 1922. The petitioners appear to be convinced that the project is not a good investment for the municipality, a bond election having been carried, it is claimed, by a preponderance of non-property-holding voters.

The outcome of this litigation will be watched with interest. Since in many cases it is believed that municipal improvements involving bond issues and special taxes are voted by non-property holders, the decision is expected to set an important precedent. The proposed installation by the municipality was small, 6,000 hp., and it was intended to use all of this in the city proper and not attempt to distribute electricity over any wide region.

BIG PIGEON DEVELOPMENT

The Chief of Engineers, U. S. A., has reported to the Federal Power Commission that the proposed hydro-electric development on the Big Pigeon River in North Carolina, close to the Tennessee line, for which a declaration of intention was filed by C. Boice several months ago, will affect interstate navigation and that therefore the federal government should take jurisdiction.

A study of the project and of the stream, it is stated by the Chief of Engineers, indicates that if the applicant will submit his application for a license accompanied by complete plans, the project probably can be passed on and the conditions to be inserted in the license decided upon without waiting for completion of the survey of the upper Tennessee River and its tributaries which is now being carried out by the district engineer at Chattanooga. This suggestion means that a delay of several months can be avoided with respect to this project if the applicant, as expected, now proceeds to file his formal application.

The contemplated development is an important one, involving an initial installation of 50,000 hp., while the ultimate output may reach as high as 150,000 hp. The power will be used for industrial purposes principally, but also will be made available for service both in Asheville and in Knoxville. The application is one of several submitted in the last few months involving large hydro-electric developments in east Tennessee and in North Carolina. The interests which are supporting Mr. Boice in this proposal have not been disclosed but will be made known when the formal application for a preliminary permit is filed with the commission.

Two Insull Properties to Consolidate

The stockholders of the Central Illinois Public Service Company and the Middle West Power Company will vote on Aug. 30 on a plan to consolidate the companies to permit more favorable financing. The proposed new company will have $10,000,000 of 6 per cent cumulative preferred stock ($100 par), 100,000 shares 6 per cent preferred non-par stock and 200,000 shares of non-par common. Exchange will be made on a share-for-share basis.

Both companies are Insull properties and subsidiaries of the Middle West Utilities Company. The Middle West Power Company was incorporated last year and has a plant under construction at Grand Tower, Ill.

Union Gas & Electric's Plans

The Union Gas & Electric Company of Cincinnati, Ohio, is steadily working on expansion plans. Negotiations are reported under way for the purchase of the Hamilton Utilities Company of Hamilton and also of the Ohio Gas & Electric Company of Middletown, which supplies Middletown, Franklin, Springboro, Medina, Leetonia and Lisbon with electricity and gas. Polk Laffoon, vice-president of the Union Gas & Electric Company, has announced that a physical inspection of the properties of the two companies has been made by the Union Gas & Electric officials with the end announced in view. Announcement of the amalgamation is expected soon.

Industrial Standardization

Unofficial International Conference Is Held in Switzerland for Exchange of Ideas

AN UNOFFICIAL conference of the secretaries of various standardizing organizations was held early in July at Zurich, Switzerland. This was the second conference of its kind held, the first conference having taken place in London in April, 1921. At that conference the secretaries of seven standardizing organizations were present, whereas at the Zurich conference secretaries from thirteen different countries were present. These included representatives from Austria, Belgium, Canada, Czechoslovakia, France, Germany, Great Britain, Holland, Italy, Norway, Sweden, Switzerland and the United States.

The conference, which lasted from July 3 to July 6, was given over to a discussion of the practical application of standards in the various countries and of the extent to which international collaboration is possible. There is a marked difference in industrial standardization and in the method of its application in the various countries involved. In Great Britain and in the United States the standardizing body is an industrial organization seeking government support, while in France, for example, the standardizing body is a government institution.

Reports were made by the various secretaries on progress in the different countries, and the American representative, Dr. Paul G. Agnew, was supported in his resolution that in order to help the cause of standardization ideas cannot be exchanged too soon. Possessing no executive authority, the recommendations made by the secretaries as a whole will have to be placed before the executives of the respective national organizations. Progress has been made, however, toward closer international collaboration between secretaries and toward international amity on questions of standards. Mr. Zollinger, secretary of the Swiss committee, acted as chairman of the conference, and C. le Maistre of Great Britain acted as vice-chairman.

Christiania Visitor Tells of Farm Service in Norway

"The Norwegian farmers are becoming electrical manufacturers on their own account," said E. A. Brofos, managing director of the Western Electric Norsk Aktieselskap, Christiania, Norway, who arrived in New York this week on a short business trip. "The cost of electrical energy is very low, as it is generated by water power, and so the great concern of the country people is to procure electrical appliances. Many are even making their own heaters. They get hold of clay drain pipes, then wind resistance wire around them, and make crude but efficient electric heaters. With these they heat their homes and barns.

"The importance of electricity in the lives of the Scandinavian people is increasing steadily," continued Mr. Brofos. "This will be noticed in passing through the sparsely settled parts of Norway, where one invariably finds even the cottages of the poorer people connected with electric wires. Both Norway and Sweden have now a large number of hydro-electric plants. These are connected in two main systems to supply these countries, and a project is under way to connect these two power systems into one great system which will supply both countries and then to run a cable from Norway across the North Sea to furnish power to Denmark, where there is little water power. The cable connecting these two countries will be the longest high-tension submarine cable in the world.

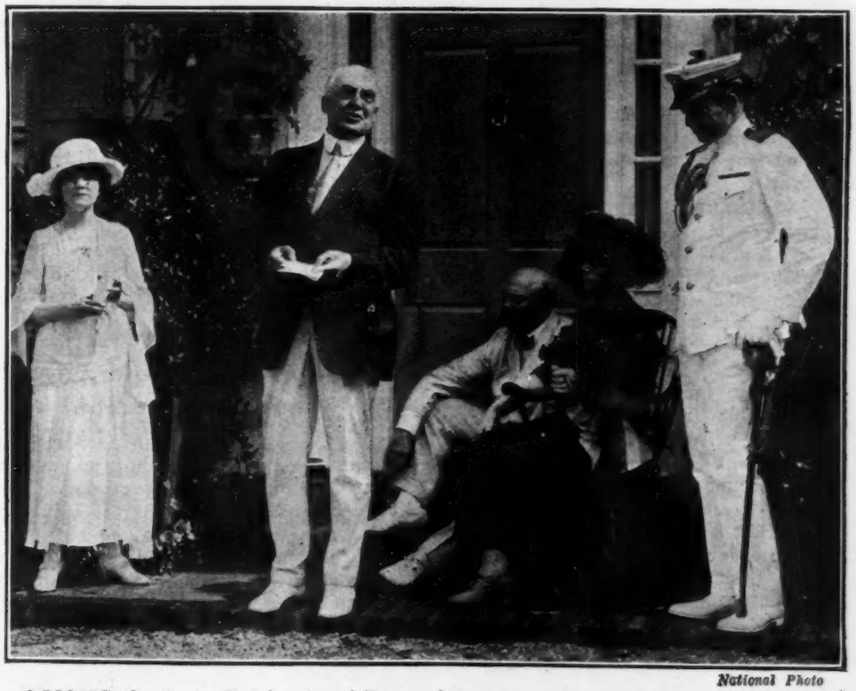
"Electricity is also used extensively by the large electrochemical works which extract nitrogen from the air in making saltpeter. A hydro-electric plant rated at 300,000 hp. has been built by one of these firms. The plant was erected in a valley where there were no houses. Within three years there had sprung up around this plant a city of 20,000 inhabitants, with churches, schools and motion pictures."

Tennessee Electric Power's Earnings Increase

Net earnings of the Tennessee Electric Power Company at the close of its first year of operation on June 30 showed a balance of $658,211, after payment of interest on first preferred stock and depreciation, according to the report made public last week. These earnings, said the statement, are equivalent to $13.01 a share on the second preferred stock and $2.29 a share on the common. Items in the income statement for the twelve months ended June 30 include: Gross income, $8,631,900; net after taxes, $3,867,275, and surplus, $1,331,027.

"Within the past year," the statement added, "the movement of Northern textile mills to raw material centers in the South has assumed new importance, owing to more economical and generally more favorable manufacturing conditions. This movement has further stimulated industrial activities, the Tennessee Electric Power Company having generated during the first six months of 1923 a total of 229,181,000 kw.-hr., compared with 164,797,000 kw.-hr. in the same period of 1922, or an increase of 39 per cent. The number of customers on June 30 was 54,447."

President Harding Opening Electrically Equipped Replica of Payne's Boyhood Dwelling



National Photo

AMONG the last official acts of President Harding before he left Washington on the Western tour from which he was never to return was the opening of a replica of the boyhood home of John Howard Payne, author of "Home, Sweet Home," which differed, however, from its prototype in possessing a very full equipment of electrical household conveniences. This home was on exhibition during June, and it will in the future, on a permanent site, be used by the Department of Agriculture for demonstrations in home economics. To the left of the late President are Secretary of War Weeks, Mrs. Harding and Commander Andrews, U. S. N. The lady on his right is Miss Lida Hafford, director of the General Federation of Women's Clubs, to whom it fell to present Mr. Harding with the key of the model electrical home.

New Jeffersonville Plant

Middle West Utilities Plans to Link Its Indianapolis and Kentucky Properties

HARRY REID, president of the Interstate Public Service Company, announced at Indianapolis last week that it is probable work will start before the end of the year on a superpower steam plant on the Ohio River just east of Jeffersonville, Ind. This plant will be erected at a cost of considerably more than $3,000,000 and will be consolidated with several important hydro-electric and steam plants in Kentucky and southern Indiana to supply electrical energy, including service to the most important traction lines in that section. These related electrical projects are said to involve a total expenditure of at least $12,000,000. They are being promoted by the Interstate Public Service Company, the Kentucky Hydro-Electric Company and the Kentucky Utilities Company, all of which are subsidiaries of the Middle West Utilities Company of Chicago. The site of the new power plant, which comprises 105 acres, will be directly across the river from the new gas station of the Louisville Gas & Electric Company.

LOUISVILLE ENERGY TO BE REPLACED

The end of the sale of Louisville-made electric power in New Albany and Jeffersonville will result from the construction of the new plant. The North Side cities, though supplied with electricity for power and lighting through a subsidiary of the Interstate Public Service Company at the present time, are dependent upon the Louisville utility for their energy. Upon the completion of the new plant there will be no longer any need to purchase this power.

The Kentucky Utilities Company will complete in 1924 a 30,000-kva. steam plant 4 miles from Pineville, Ky., on the Cumberland River, and the Kentucky Hydro-Electric Company is to build a 260-ft. dam 2 miles from the mouth of the Dix River, where 20,000 kva. will be developed. The Kentucky Utilities Company has under construction a 66,000-volt transmission line, capable of being raised to 132,000 volts, for the distance of 95 miles between the Cumberland and Dix Rivers. The Kentucky Hydro-Electric Company will in turn construct a 66,000-volt line to Lexington in order to dispose of its output and from that point will extend the line to a point on the Ohio River near Louisville.

The Interstate Public Service Company now has two power lines from Louisville to Indianapolis, one from Jeffersonville to Bedford and Seymour and the other by way of its traction route to Franklin, Edinburg, Columbus, Seymour and Jeffersonville. These lines will eventually be connected with the Jeffersonville plant so that it will be possible to transmit energy as far north as Indianapolis.

The two transmission lines of the Kentucky Hydro-Electric Company, from Dix River to Lexington and thence to Louisville, will cost, with the plant, approximately $6,000,000. Mr. Reid, who is president of the two Kentucky companies as well as the Indianapolis company, is enthusiastic about the proposed unification of these plants, which will make for the greatest possible economy of operation.

Illinois Power Buys Missouri System

The Illinois Power & Light Corporation has purchased the Missouri Utilities Company of Mexico, according to an announcement made by E. R. Locke, vice-president, and Wiley F. Corl, general manager of the latter company. The Missouri company serves seventeen other towns in Audrain, Montgomery, Callaway and Boone Counties. The Illinois Power & Light Corporation is the combination of the McKinley and the Studebaker public utilities interests which became effective during the spring. It is also understood that the organization has acquired the Moberly Electric Light & Power Company, the Adair County Light & Power Company of Kirksville and the Boonville Light, Heat & Power Company from W. A. Baehr & Company. The acquisition of these properties will bring closer electrical union between the western and eastern parts of the state, since the Illinois property at Perry distributes energy taken from the Keokuk Dam and is but 25 miles from Vandalia, the eastern terminus of the Missouri utilities lines. With the western terminus of the Missouri utilities at Clark, 8 miles from Higbee, and the eastern terminus of the Kansas City Power & Light Company at Armstrong, about 12 miles west of Higbee, a transmission line of 25 miles between Perry and Vandalia could establish direct connections from Kansas City to Hannibal with extensions into Kansas and Illinois and through Keokuk into Iowa.

Combined Fire and Safety Code Contemplated

The American Engineering Standards Committee announces the appointment of a committee to arrange for a conference to decide whether it would be advisable to draw up a combined fire and safety code and to outline the procedure and policies to be followed at the conference. At present two separate codes are in force—the National Electrical Code, which prescribes methods of wiring, fixture and machine installation with respect to fire hazard, and the National Electrical Safety Code, which deals primarily with personal hazards. Since both provide guides for materials and methods of electrical construction, it is clear that either co-ordination or combination of the codes is a desideratum. The proposed conference will not be called until after October.

Denver Forging Ahead

Five-Million-Dollar Program of the Doherty Company Is Being Pushed to Completion

AN IMPROVEMENT program calling for an expenditure of more than $5,000,000 is now under way by the Denver Gas & Electric Light Company and other subsidiaries of Henry L. Doherty & Company operating in Colorado. A large portion of this amount covers the initial installation of the new 20,000-kw. generating plant near Valmont, Col., a project announced several months ago and on which work is actively proceeding.

The finished station at this point will include additional equipment to double the primary generating capacity. With the required transmission system, the total cost is estimated close to $12,000,000. This amount, however, does not include the expenditures which are now being made by the Denver Gas & Electric Light Company for bettering distribution service within the city of Denver.

Already three automatic rural substations have been cut in to accommodate the companies serving the towns of Golden, Arvada, Littleton, Englewood and Fort Logan. Another automatic substation, to be known as the "North Sub" but located at Thirty-ninth and Columbine Streets, East Denver, is expected to be in operation by Jan. 1, according to D. C. McClure, electrical superintendent of the company, under whose direction the various improvements are being made. When completed it will cost about $100,000 and will compiete about one-half of the industrial-belt distributing system. Later, it is understood, another substation will be erected to complete the system.

Enlargement of the original Denver power house, now known as the "Barker Sub," at Twenty-first and Wewatta Streets, is being accomplished at a cost in excess of $100,000. Growth of the company's load in the business section of the city has necessitated this addition. A similar amount is being spent on new transmission lines within the city. The unprecedented building program in Denver during the past year, especially in outlying residence sections, has necessitated numerous extensions, and to serve those districts adequately the company has been engaged most of the summer in the installation of the new pole lines.

CONNECTING THE LAKESIDE PLANT

In connection with the Denver transmission system plans for bringing in the lines from the new Lakeside plant are being developed. Steel-core aluminum cables mounted on steel towers will be used for transmitting energy at 90,000 volts to the Denver terminal substation, where it will be cut down to 22,000 volts for distribution to the other substations. The outdoor terminal substations will be at the West Denver generating plant, which probably will be shut down for all other purposes after the new north plant is ready.

New Employment Plan

Co-operative Method Worked Out by the Secretaries of the Four Major Engineering Bodies

A NEW "co-operative employment plan" for the benefit of members of the four major national engineering associations has been prepared by the secretaries of these bodies acting as a committee to solve the problems formulated in the report of a previous joint committee of the four societies which, under the chairmanship of W. I. Slichter, professor of electrical engineering at Columbia University, had submitted a report to the governing bodies on March 17 last. The secretaries' report has been accepted by these governing bodies, and the plan recommended will go into operation by Sept. 1.

This plan provides for the continuance of free service to a limited extent, principally by the free publication of announcements of available men in the respective journals of the four societies and by the personal efforts of the secretaries, but sets up in addition a national employment service that will be partly supported by those directly benefited. To accomplish this the societies are to underwrite the joint employment bureau already existing in the sum of $16,000, prorated according to the placements made last year, but they need actually appropriate only one-half of this sum, the expectation being that the other half will be derived from fees to be charged those obtaining employment through the aid of the bureau. The arrangement works out as follows:

	Placements Last Year	Appropriation Asked	Amount to be Underwritten
A. S. M. E.	1,150	$4,130	$8,260
A. S. C. E.	505	1,815	3,630
A. I. E. E.	450	1,635	3,270
A. I. M. and M. E.	120	420	840
Total	2,225	$8,000	$16,000

The maintenance charge to be made to those registering with the bureau beginning Sept. 1 next will be on the following basis for the first year, with such adjustments later as may be deemed necessary: For all situations procured paying $2,000 or less a year, $10; for situations paying in excess of $2,000, $10 plus 1 per cent on the amount of salary above $2,000. Thus for a situation paying $2,500 the fee would be $15, for a situation paying $5,000 the fee would be $40, and so on. An annual gross income of $30,000 from this source is estimated. Any surplus is to be used for extending the service to other cities.

Registration of available men is restricted to members of the four societies, at least until the plan shall have proved to be satisfactory and financially sound. Later it may be extended to include members of all organizations exchanging courtesies with the major societies and members of affiliated student engineering organizations. The publication of "Positions Available" in the respective journals of the societies will be discontinued, and in its stead there will be substituted an employment bulletin to be sent out at suitable intervals only to those who are properly registered.

It was shown in the report of Professor Slichter's committee that 61 per cent of electrical engineers, 52 per cent of mechanical engineers, 48 per cent of civil engineers and 31 per cent of mining and metallurgical engineers using the old employment service had obtained situations. Still better results are hoped for under the new plan.

World's Northernmost Railroad Now Electrified

The Ofoten railroad in Norway was formally reopened to traffic on July 10 after electrification. This road, which was originally operated by steam after its completion in 1902, is 26 miles long and runs between the seaport of Narvik and the Swedish border. Its location between north latitudes 68 and 69 makes it the most northerly railroad in the world. It is standard-gage, with a maximum grade of 17.3 per mile and a high altitude of 1,700 ft. above sea level. Electrification is expected to increase the rate of speed about 70 per cent and the capacity of the railroad in proportion. The chief freight is iron ore from the vast deposit in Swedish Noorland. In 1920 2,400,000 tons of this ore was hauled.

The electricity for operating the road comes from the water-power plant at Porjus, Sweden. The transmission line is about 125 miles in length and the voltage is 80,000, the highest yet used in Norway. At two substations along the line this voltage is reduced to 16,000 and fed to the locomotives. Nine of these will replace the sixteen steam locomotives previously used. This is the fourth electric railroad in Norway, where, because of the immense water powers and the lack of coal, it is only a question of time when all the lines will be operated by electricity.

Lighting the Air Mail Path

Thirty-five High-Power Searchlamps Will Illuminate the Dark Zone of 800 Miles

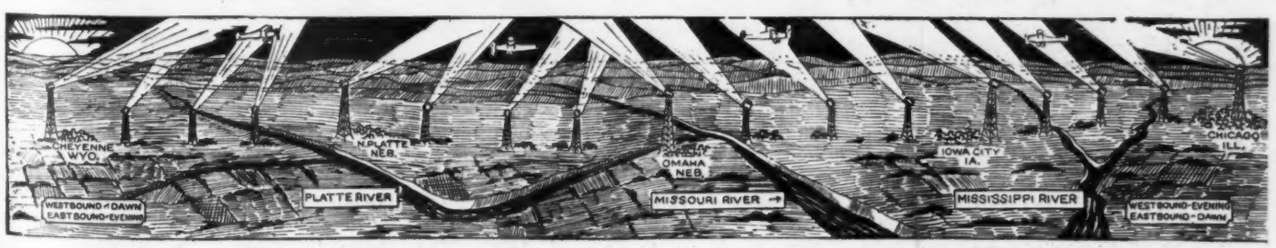
A UNIQUE system of high-power searchlight beacons to illuminate the pathway of airplanes will mark the inauguration of the first United States Air Mail Service, scheduled to start about Aug. 15. A total of 1,800,000,000 cp. in thirty-five arc and incandescent type searchlamps, just installed by the General Electric Company, will light the dark zone of the transcontinental route beginning at Chicago and extending to Cheyenne, Wyo. At the eastern edge of this zone a beacon of 325,000,000 cp. has been stationed, and at the western boundary, 800 miles away, a unit of like intensity has been installed. Between these are three others of similar size at points where permanent landing fields are being laid out—Iowa City, Omaha and North Platte. At lesser intervals of about 25 miles thirty 5,300,000-cp. incandescent searchlamps have been installed.

The large-type lamps, marking the beginning and end of the "darkness zone" and the landing fields, are mounted on steel-frame towers 60 ft. high or on suitable buildings if available. Geared motors of ½ hp. will keep the big lights revolving in a circular path, and ¼-hp. motors will keep the smaller lights in motion. It is estimated that the big lights will be visible a distance of 50 miles and the smaller ones for 30 miles. Thirty-six-inch projectors will be used for the big lights and 18-in. projectors for the smaller ones.

Central-Station Service

Power will be supplied for the big lamps in the larger cities from central-station service. Where such power is not available, particularly for the smaller lamps scattered along the route, power will be furnished from gasoline-engine-driven generator sets at 30 volts direct current by means of units rated at about 1½ kw.

The detailed lighting of the landing fields themselves has been laid out by the Post Office Department with the following objectives in view: definition of field limits, lighting of obstructions, indication of landing levels, illumination of landing stages, definition of the taxi strip, indication of wind direction and force, beacon (orientation) lighting-field identification markings and emergency lighting.



LIGHTING THE PATH OF THE UNITED STATES MAILS FROM CHICAGO TO CHEYENNE

Appointments Made on A. I. E. E. Committees

At the first meeting of the board of directors of the American Institute of Electrical Engineers for the administrative year beginning Aug. 1, 1923, held in New York on Thursday, Aug. 2, President Ryan announced the following appointments as chairmen of committees:

STANDING COMMITTEES

Board of Examiners—H. H. Norris, New York.
Code of Principles of Professional Conduct—John W. Lieb, New York.
Co-ordination of Institute Activities—W. I. Slichter, New York.
Edison Medal—Edward D. Adams, New York.
Executive — Harris J. Ryan, Stanford University, Cal.
Finance—G. L. Knight, Brooklyn, N. Y.
Headquarters—E. B. Craft, New York.
Law—H. H. Barnes, Jr., New York.
Meetings and Papers—L. W. W. Morrow, New York.
Membership—M. E. Skinner, Pittsburgh.
Publication—Donald McNicol, New York.
Public Policy—H. W. Buck, New York.
Research—J. B. Whitehead, Baltimore.
Safety Codes—H. B. Gear, Chicago.
Sections—A. W. Berresford, Milwaukee.
Student Branches — C. E. Magnusson, Seattle.
Standards—H. S. Osborne, New York.

TECHNICAL COMMITTEES

Educational—W. E. Wickenden, New York.
Electrical Machinery — H. M. Hobart, Schenectady, N. Y.
Electrochemistry and Electrometallurgy—J. L. Yardley, Pittsburgh.
Electrophysics—F. W. Peek, Jr., Pittsfield, Mass.
Industrial and Domestic Power—H. D. James, Pittsburgh.
Instruments and Measurements — G. A. Sawin, Pittsburgh.
Iron and Steel Industry—F. B. Crosby, Worcester, Mass.
Lighting and Illumination—G. H. Stickney, Harrison, N. J.
Marine—G. A. Pierce, Jr., Philadelphia.
Mines—F. L. Stone, Schenectady, N. Y.
Power Stations—Nicholas Stahl, Providence.
Protective Devices — H. R. Woodrow, Brooklyn, N. Y.
Telegraphy and Telephony—O. B. Blackwell, New York.
Transmission and Distribution — F. G. Baum, San Francisco.

In accordance with the bylaws of the Edison medal committee, the board of directors confirmed the appointment by President Ryan of new members of this committee for terms of five years each as follows: C. C. Chesney, Pittsfield, Mass.; Robert A. Millikan, Pasadena, Cal., and M. I. Pupin, New York. The board also elected three of its members as members of the Edison medal committee for terms of two years each, namely, H. M. Hobart, Schenectady, N. Y.; Frank B. Jewett, New York, and W. K. Vanderpoel, Newark, N. J.

Appointments in New England Division, N. E. L. A.

The following chairmen of sections have been appointed within the New England Geographic Division of the National Electric Light Association for the coming year: Accounting Section, Franklin L. Hall, Providence; Technical Section, A. H. Sweetnam, Boston (vice-chairman, J. P. McKearin, Springfield); Commercial Section, E. S. Hamblen, Franklin, Mass.; Public Relations Section, E. L. Milliken, Woonsocket, R. I. Committee heads who have accepted appointment are: Prime movers, A. L. Nelson, Boston; electrical apparatus, H. A. Stanley, Fall River; meters, H. L. Thomson, Hartford; inductive co-ordination, James A. Vahey, Boston; underground distribution, L. R. Hicks, Boston; merchandising bureau, L. A. Fiorani, Franklin, Mass.; wiring, R. S. Hale, Boston; new business, H. J. Walton, Malden, Mass.; lighting, J. Daniels, Boston; contact, H. B. Gilmore, Boston; accident prevention, F. W. Randall, Portsmouth, N. H.; taxation, Bowen Tufts, Boston; employees' relations with the public, A. B. Lisle, Providence; relations with bankers, T. C. Fales, Boston; women's public information bureau, Miss G. M. Thibodeau, Malden.

Brief News Notes

Kansas City Company Acquires Sweet Springs Plant.—Authority to purchase the Sweet Springs (Mo.) electric light plant has been granted the Kansas City Power & Light Company, which will construct a 33,000-volt transmission line from Blackburn to Sweet Springs.

Dates Set for Scranton's Electrical Show.—The week of Nov. 5-10 has been set as the date of the electrical show for northeastern Pennsylvania, which, as already announced, is to be held at Scranton, with many educational features and exhibits from manufacturers and dealers.

Geological Survey Will Map Colorado River.—The United States Geological Survey began on Aug. 1 the surveying and mapping of a 300-mile stretch of the Colorado River to aid in developing the waters of the 1,500-mile stream for irrigation and power and to lessen danger from floods in the Imperial Valley. This 300-mile stretch, officials of the Interior Department state, includes the ruggedest and most dangerous parts of the Grand Canyon, which has not yet been surveyed in any detail.

Wisconsin Community to Abandon Municipal Plant.—The Norwalk (Wis.) Village Council has decided to sell its municipal electric light and power plant and obtain energy from the Wisconsin-Minnesota Light & Power Company. This resolution is awaiting the Railroad Commission's approval. If this is obtained, a special election will be held to approve the Council's action. A three-phase line from Norwalk to Cashton to connect with the main 66,000-volt transmission line of the Wisconsin-Minnesota company is planned.

Idaho Power Company Seeks Higher Rates.—An application for an increase in power rates has been made to the Idaho Public Utilities Commission by the Idaho Power Company, which bases its claim on the valuation fixed by the commission in 1919 together with additions made up to Dec. 31, 1922. The company's valuation is in excess of $17,000,000. Any increase is being fought by the Idaho Power Users' Association. The company has filed a new set of rates which it wishes to become effective Oct. 1. The state commission has ruled that this tariff cannot become effective until Oct. 20. Further hearings on the rate increase will be held Sept. 10.

Canadian Utility Companies to Merge.—At a joint meeting of the directors of the Quebec Railway, Light, Heat & Power Company and the directors of the Quebec Power Company it was unanimously decided by the directors of the former company to advise the shareholders of the Quebec Railway company to accept an alliance with the Quebec Power Company on a basis which will reduce the common stock of the first-named company from $10,000,000 to $2,500,000.

Work Begun on Four-Mile Tunnel.—Driving of the 20,000-ft. tunnel of the Pacific Gas & Electric Company that is to carry water to the Pit River power house No. 3 was started July 22. Work started on the eastern portal. Two separate tunnels are to be drilled out of the rock and the ends of these will be cemented together in order to deliver water at an effective head of 300 ft. Four working faces will be used by the crews driving the tunnels. Four miles up stream from the power house a dam 110 ft. high will be erected, which will back up the river for a distance of 9 miles. The lake thus formed will be about a mile and a half wide at its widest part.

Texas Property Sold.—The Western Public Service Company, with district branch office in Navasota, announces the purchase of the Calvert (Tex.) Water, Ice & Electric Company. The properties just purchased include the water, light and ice plant at Hearns, Tex., and the water, light and ice plant at Calvert, with a transmission line from Calvert to Bremond and the lighting system in Bremond. The owners announce that transmission lines will be built from Calvert and Hearne to other towns in central Texas. The Western Public Service Company is a Colorado corporation with home offices in Colorado Springs. It owns and operates a large number of utility properties in Texas.

Revival of a Coosa River Project.—The People's Hydro-Electric Company of Birmingham, Ala., with $30,000 capital stock, proposes development of an average of 40,000 hp. at Lock 2 on the Coosa River, which is the northernmost power site on that stream. It is 20 miles south of Gadsden and near Greenspoint, Ala. The cost is figured at from $2,000,000 to $5,000,000. Roswell C. Cobb is president of the company, which has applied to the Public Service Commission for authority to build the dam. Application will also be made to the Federal Power Commission. The People's Hydro-Electric Company was chartered in 1914 and took over the

interests of the Coosa River Electric Power Company, which had secured the dam site as far back as 1907.

Montana and Washington Power Companies to Be Interconnected.—Construction of a 110,000-volt transmission line between Burke and Wallace, Idaho, a distance of 7 miles, to be completed late next fall, has been announced by the Washington Water Power Company. This connecting line will link the system of the Montana Power Company with the system of the Washington Water Power Company. The connection will complete the last step in providing an interconnected transmission line from Billings, Mont., to Seattle, Wash., a distance of 650 miles as the crow flies. An outdoor substation will be built at Wallace.

One-Pair Telephone Cable Has Made Seven Simultaneous Conversations Possible.—Making seven conversations flow where but one flowed before is the engineering achievement credited to telephone engineers, who have just finished laying a one-pair submarine telephone cable between Catalina Island, off the southern California coast, and the mainland, 25 miles away. An interesting feature of the one-pair cable is that the seven conversations are carried on simultaneously over a single strand of copper wire in the center of the cable, a system of varied frequencies similar to that used in radio telephony making this possible. This cable has superseded the commercial radio link previously operated between Catalina and the mainland.

J. G. White Corporation to Administer Staten Island Company. — The Richmond Light & Railroad Company, which served Staten Island (forming the Borough of Richmond, New York City) with light and power as well as electric railway service, has been taken out of the hands of a receiver, in which it has been for more than three years, and turned over to the J. G. White Management Corporation for administration. The lighting business will be separated from the railway business and carried on by the newly organized Staten Island Edison Corporation, which will finance both lighting and railroad properties. According to a statement made by J. H. Pardee, president of the J. G. White Management Corporation, the properties are entirely solvent and with new capital behind them the outlook is bright.

Los Angeles' Power Bureau's Plans Are Blocked Again.—For the fifth time the Public Service Commission of Los Angeles has been defeated in its efforts to obtain blanket authority from the City Council to spend $25,000 for preliminary expenses incidental to its plan to take over the seventeen-million-dollar electric properties of the Los Angeles Gas & Electric Corporation. Councilman Mushet, who has consistently opposed the ordinance, said: "The Power Bureau should complete its power development along the aqueduct before taking on any new business. The Power Bureau is now buying from the Edison company half of the power the city sells. I believe that the people would prefer to have their $17,000,000 used for improvements which the city must make and which no one else can make, rather than to use that amount of money for taking over another company's electric business."

Montana Power Company Project Progressing.—Work on the Montana Power Company's new hydro-electric project at Mystic Falls, 20 miles southwest of Billings, is progressing satisfactorily. Its completion will enable the company to supply that section of Montana with electricity under more economical conditions. The new plant will have an initial installation of 12,000 kw. and will cost approximately $1,250,000. No dam is to be constructed to supply the plant, the water being taken through pipes set in a tunnel to the right of the falls and extending to the lake beyond, from which the water will be pumped to the penstocks. Completion of this plant will round out the company's system in that part of the state and add to its earning capacity.

Isolated Plants Authorized in Indiana.—The Indiana Public Service Commission has ordered the trustees of Purdue University to include an electric generating plant in the new power house to be erected for the school. The last Legislature appropriated $275,000 for the power house, but directed that no electric generating plant be included unless the commission, after a hearing, should decide that the school could thus provide its own electrical energy cheaper than it could be bought from a central station. The commission was of opinion that the university could do this. In a similar case recently the commission ordered the trustees of the Robert W. Long Hospital, the Indiana University School of Medicine and the James Whitcomb Riley Hospital for Children in Indianapolis to include an electric generating plant in the new power installation for these institutions.

Topeka Edison to Build New Plant.—It has been announced by Albert N. Patten, assistant general manager of the McKinley interests, that the Topeka (Kan.) Edison Company has acquired 50 acres of land below Tecumseh, 6 miles from Topeka, on which it will immediately erect a steam generating plant to cost $2,500,000 and have an initial rating of 15,000 kw. in two equal units. This plant will supply Topeka and surrounding territory, and after it is completed the present 6,000-kw. city plant will be operated only to furnish heat and for emergency purposes. Tecumseh is on the Kaw River, but it is said that the amount of hydro-electric power that could be produced there is so small that the expense of development is not warranted. Coal from southeastern Kansas will be used and storage for nine to twelve months provided. A steel-tower line will be built to Topeka.

Associations and Societies

Electric Club of Los Angeles.—The first annual outing of the Electric Club of Los Angeles is to be held Aug. 24 and 25. The outing will be in the form of a boat trip to San Diego.

Pennsylvania State Association of Electrical Contractors and Dealers.—All branches of the industry are invited to attend the semi-annual meeting of this body to be held at the Sterling Hotel, Wilkes-Barre, on Sept. 12 and 13.

Electrical Supply Jobbers' Association, Pacific Division.—This association will hold its regular quarterly meeting at Gearhart, Ore., Sept. 5, 6 and 7. The entertainment features are being handled by the northern members.

Casper (Wyo.) Electric Club.—The second organization to develop the "Electrify" movement in Wyoming is the Casper Electric Club, which comprises the leading contractor-dealers and representatives of the central station in that city. W. J. Sherwood, city electrician, has been elected president, and the other officers are P. M. Van Sickle, vice-president, and J. B. Flannagan, American Electric Company, secretary and treasurer. Dinner meetings are held weekly.

Coming Meetings of Electrical and Other Technical Societies

[A complete directory of electrical associations is published in the first issue of each volume. See July 7 issue, page 56, for latest list.]

New England Division, N. E. L. A.—Swampscott, Mass., Sept. 5-8. Miss O. A. Bursiel, 149 Tremont St., Boston.

Pennsylvania Electric Association—Bedford Springs, Pa., Sept. 5-8.

Electrical Supply Jobbers' Association, Pacific Division—Gearhart, Ore., Sept. 5-7. A. H. Elliot, 502 Flatiron Bldg., San Francisco.

Conference of Electrical Leagues.—Association Island, Sept. 16-19. Society for Electrical Development, 522 Fifth Ave., New York.

Rocky Mountain Division, N. E. L. A.—Glenwood Springs, Col., Sept. 17-19. O. A. Weller, 900 15th St., Denver.

Association of Edison Illuminating Companies—Dixville Notch, N. H., Sept. 17-21. P. S. Millar, 84th St. and East End Ave., New York.

Michigan Electric Light Association—Grand Rapids, Sept. 18-20. Herbert Silvester, Detroit Edison Co., Ann Arbor.

Illuminating Engineering Society—Lake George, N. Y., Sept. 24-28. S. G. Hibben, 29 West 39th St., New York.

Association of Iron and Steel Electrical Engineers — Buffalo, Sept. 24-28. J. F. Kelly, 513 Empire Bldg., Pittsburgh.

Indiana Electric Light Association—French Lick Springs, Sept. 26-29. T. Donahue, Northern Indiana Gas & Electric Co., Lafayette, Ind.

American Electrochemical Society—Dayton, Ohio, Sept. 27-29. Colin G. Fink, Columbia University, New York.

American Institute of Electrical Engineers—Pacific Coast convention, Del Monte, Cal., Oct. 2-5. F. L. Hutchinson, 33 West 39th St., New York.

Empire State Gas and Electric Association—Lake Placid, N. Y., Oct. 8-9.

Association of Electragists International—Washington, Oct. 8-13. Farquson Johnson, 15 West 37th St., New York.

Commission Rulings

Commission Jurisdiction Over Sale by City.—The Indiana Public Service Commission has held that it has no power to review the action of the board of trustees of Cambridge City in preparing for and making the sale of a municipal light plant, but that if errors or irregularities entered into the proceedings or if the discretion of the town board was improperly exercised, such matters are questions for the courts. The petition by a public utility company to intervene in a proceeding for the approval of a contract for the sale of the electric light plant was denied where it appeared that the utility was not a resident of the town or a taxpayer thereof and that it had no vested rights as utility in the town.

Acquirement of Mining Stock by Utility Disapproved. — The California Railroad Commission has held void a promissory note issued by the Alturas Electric Power Company to acquire 200,000 shares of the capital stock of a gold-mining company. The commission said: "It is alleged that applicant acquired an interest in the mining company for the purpose of endeavoring to procure additional business. To date no additional business has been obtained by applicant as a result of the purchase of the mining stock. Even if such business had been obtained, we do not believe that a utility is authorized to issue notes to acquire stock of a mining company under the circumstances outlined in this proceeding. The note is void under the provisions of the public utilities act."

Transformer Charges and Rural Customers. — Permission to place transformer charges in effect for all consumers was denied by the Wisconsin Railroad Commission to the Leopolis Electric Light & Power Company, although the company alleges that the collection of a transformer charge from rural consumers only constituted discrimination against these consumers. The commission said that it had specifically excluded consumers in more densely populated territory from the transformer charge because it was found that the costs of serving a consumer in a well-developed community are much lower than for a rural consumer. "This is not entirely due to the difference in transformer losses," said the commission. "Rural service requires a much larger investment per consumer, and while it is true that in many cases the rural consumer makes this investment and there is, therefore, no interest charge for the company to carry, the other charges, including maintenance, depreciation and taxes, make the costs much in excess of those for local service. Local service permits of the connection of a number of consumers to one transformer with consequent saving in investment and transformer losses."

Basis for Meter Rates.—The establishment of meter-rate schedules cannot readily be based upon a valuation of utility property coupled with a study of earnings and expenses, where flat rates have prevailed in the past, since operating costs when service is unmetered are likely to be quite different from such costs after meters are installed, the New Jersey Board of Public Utility Commissioners asserted in adjusting a complaint brought against the Branchville Electric Power, Water & Light Company. The board continued: "The record of the output of the plant would have no meaning in connection with the development of meter-rate schedules as it is customary to allow lamps to burn continuously where there are no meters and it is practically impossible to determine with any degree of exactness just what effect the meters would have upon the output of the plant and upon the consumption of energy by individual customers. The adoption of a schedule of meter rates where service has been previously furnished at flat rates must, therefore, be determined by the selection of a schedule which has apparently been equitable in communities of a somewhat similar character and size."

Valuation of Power Rights on State Dam.—In fixing electric rates for the People's Gas & Electric Company of Oswego, the New York Public Service Commission acknowledged its difficulty in evaluating the property of the company, which, besides purchasing energy from the Niagara, Lockport & Ontario Power Company and the Fabri company, has a plant on the Barge Canal, whence it derives surplus water. The commission said that it had "taken into consideration the facts that the water flow of the Oswego River in the city of Oswego is a natural resource, that the state built and maintains the dam from which the use of one-half of the surplus waters not required for navigation is taken for the hydraulic canal, that there is no means of conserving the water and preventing waste beyond the actual requirements of the People's Gas & Electric Company, that although this company has given a continuous twenty-four-hour service its load falls off during that period of time and it uses only the quantity of water necessary to carry the light load during that period of service and the rest of the water is absolutely wasted." The commission also considered the fact that there is a surplus of water at Oswego. Another consideration which received its attention is that "the locality should receive certain advantages in the increment or increased value of these water-power rights." The commission finally determined the fair present value of the company's land and water rights, for the purpose of a rate base, to be $250,000.

Recent Court Decisions

Opening and Closing Water Gates to Injure Public Utility Company Enjoined.—In Fulton County Gas & Electric Company vs. Rockwood Manufacturing Company the plaintiff sought to restrain the defendant from manipulating the waters in Caroga Creek to the injury of the former. It was shown that the defendant had erected a dam upstream from that of plaintiff and that it repeatedly closed its gates until its pond was full and then opened them wide, discharging the entire contents, so that the plaintiff was alternately without water and with too great a flow. No reason for defendant's action was shown, the manufacturing company making no use of its own riparian rights, though complaining that the central-station company had no right to maintain storage dams at two lakes which discharge into the creek and from which the plaintiff was forced to draw extra quantities of water because of defendant's conduct. The Supreme Court of New York, Appellate Division, affirmed judgment for the plaintiff, declaring that a riparian owner, having equipped a plant with machinery within the reasonable capacity of the stream, has a right to have the water flow continuously in its natural course and quantity without obstruction by an upstream owner. (200 N. Y. S. 225.)*

Municipal Power to Contract for Utility Rates Must Be Expressly Granted.—In supporting the refusal of the lower court to grant to the city of Uvalde an injunction against an increase of rates by the Uvalde Electric & Ice Company, on the ground of breach of contract, the Commission of Appeals of Texas said that the power of a city to regulate rates to be charged for electric lights for the use either of the municipality or of the inhabitants is a governmental power which could not be surrendered or suspended by a contract between the city and a public service company; hence a ten-year contract between the city and the company fixing the rates to be charged was void, being neither expressly nor impliedly authorized by law. The Legislature, said the court, may expressly authorize municipal corporations to enter into contracts prescribing rates to be charged by utility corporations for a specified time, which contracts when made have the effect of suspending during their duration the governmental power to regulate such rates, but for a contract to have that effect the authority to make it must be clear and unmistakable, and all doubts must be resolved against the authority of the municipality to make such contract. (250 S. W. 140.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men Engaged in all Branches of the Electrical Industry

L. S. Streng Elected Vice-President of Louisville Company

L. S. Streng, for some time chief engineer and general superintendent of the Louisville Gas & Electric Company, was elected vice-president of the company at a recent meeting of the board of directors. Mr. Streng was graduated from the Massachusetts Institute of Technology with the degree of bachelor of science in electrical engineering in 1898 and one year later became associated with the General Electric Company at Schenectady, N. Y. Subsequently he was made assistant chief engineer of the Public Service Corporation of New Jersey, which position he resigned seventeen years ago to become chief engineer of the Kentucky Electric Company. In 1913 be became chief engineer and general superintendent of the company of which he is now a vice-president.

L. S. STRENG

C. D. SeCheverell Resigns from Railroad Commission

C. D. SeCheverell, for the past four years secretary of the Wisconsin Railroad Commissioner, has resigned to join the Middle West Utilities Company organization, where he will be assistant to Martin J. Insull, president of the Central Power Company. For the present Mr. SeCheverell will be stationed at Grand Island, Neb. For a number of years previous to his association with the commission at Madison he was an executive of the Superior (Wis.) Water, Light & Power Company, resigning to engage in war work. William Dineen, who has been connected with the commission for the past sixteen years, has been appointed secretary to succeed Mr. SeCheverell.

H. A. Joslin, manager of the Mountain States Power Company at Dallas, Ore., for the past four years, has resigned to take up new work in Portland.

C. L. Fortescue has recently been appointed manager of the newly created porcelain insulator and transmission engineering department of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

Charles L. Leighton, manager of the Minnesota Electric Light & Power Company at Cushing, Okla., recently resigned to ally himself with the Fort Smith (Ark.) Light & Traction Company as manager of its commercial department.

R. Z. Zimmermann, heretofore manager of the Salem (Ohio) Lighting Company, has been transferred to the Columbus, Newark & Zanesville Electric Railway property as manager of the Zanesville division. Mr. Zimmermann is succeeding E. O. Shryock, who has been made manager of the Youngstown & Suburban Railway Company.

C. J. Killian, formerly connected with the power engineering department of the Ohio Power Company's Canton division, has recently been transferred to the southern division as superintendent of the Lancaster district, succeeding S. F. McCracken, who resigned to ally himself with the Luffer Oil & Gas Company.

V. E. Bird, resident manager of the Connecticut Power Company, New London, Conn., has been appointed vice-president of the Connecticut Profit Sharing Company, which has been organized by various electrical utilities in Connecticut to further the sale of electrical merchandise through a system of coupon exchange. Mr. Bird will handle this work in addition to his duties with the Connecticut Power Company.

John T. Kester, who has been district manager for the Wabash Valley Electric Company, Sullivan, Ind., for about three years, has been transferred to Noblesville, where he will become district manager for the Central Indiana Electric Company, of which the Wabash Valley is now a part. Mr. Kester will have charge of the company's business in four counties, Hamilton, Tipton, Montgomery and Madison. He was superintendent of an electric and ice company at Noblesville for twelve years before going to Sullivan.

E. R. Hannibal, superintendent of the Interstate Utilities Company of Spokane, has been elected chairman of the Spokane Section of the American Institute of Electrical Engineers. For a number of years Mr. Hannibal was associated with the Mountain States Telephone & Telegraph Company and its predecessor, the Rocky Mountain Bell Telephone Company, and previous to his connection at Spokane he was identified with the Intermountain Electric Company in Salt Lake City as superintendent of shops. Mr. Hannibal is a graduate of the University of Utah.

Frank Espy New President of O. E. L. A.

Frank Espy, the new president of the Ohio Electric Light Association, has been engaged in the central-station business practically all his life and during late years has concentrated his efforts on the State of Ohio. At present he is connected with the Ohio Power Company at Canton, in charge of the subsidiary companies of the American Gas & Electric Company in that state. During the fourteen years Mr. Espy has been performing the duties of this office he has shown a vital interest in utility affairs in Ohio. He spent three years in the East, two in charge of the Atlantic City Electric Company and a year in the office of the American Gas & Electric Company at New York. Mr. Espy has been a prominent member of the Ohio Electric Light Association, serving during the past year as its vice-president.

FRANK ESPY

A. C. Babson, for five years vice-president and general manager of the West Virginia Water & Electric Company, with headquarters at Charleston, W. Va., has been made vice-president and general manager of the Merchants' Heat & Light Company of Indianapolis, as the successor of Charles O'Brien Murphy, who recently resigned. The appointment was made by Joseph H. Brewer, head of the Brewer interests, which own the Merchants' company. Mr. Brewer, accompanied by P. D. Kline, vice-president of the Wisconsin-Minnesota Light & Power Company, also one of the Brewer companies, and L. B. Andrus, chief engineer of the Brewer companies, went from Grand Rapids to Indianapolis to install Mr. Babson in his new position.

Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

Should Motors or Organization Be Sold?

Policy Includes Service of Instrument for Getting Something Done—Advising Manufacturers of Motor-Driven Devices—Question of Prompt Deliveries

By J. M. Barr
General Manager Louis Allis Company, Milwaukee

FOR many years the Louis Allis Company, formerly the Mechanical Appliance Company, has worked on a method of selling motors which, from the standpoint of stability of the results obtained, has developed from a plan to a definite selling policy.

This policy is predicated on the broad principle that what we are selling is not a motor at all, but rather an instrument for getting something done. Therefore, the instrument we build is very much more complex than a mere motor. It involves certain basic attributes and does not consist merely of cast iron, electric sheet and copper, but contains a number of very human elements. This instrument must be capable of being ordered from the manufacturer as needed, must be available in reasonable time after it is ordered, its mechanical and electrical integrity must be a matter of course, and its characteristics naturally must be adapted to the work in hand. After being applied to the machine which it is to drive, it must go into the field not merely as a motor but with the continued support and backing of its home organization. It must carry with it continuously the certainty of service. This instrument must also be sold at a fair price commensurate with materials, labor, engineering thought and service, which must go into the instrument at the time of making and remain an integral part of it after it has been placed in the hands of the ultimate customer.

These latter factors apply not only to the highly specialized motors for a specific purpose but also must enter into the commercial service which goes with the so-called general-purpose motor as distinguished from highly specialized machines for a specific application.

It has been the practice for many motor manufacturers to sell their machines in competition, motor against motor, making many claims for individual technical superiority. While we do not discredit in any way that design and construction

J. M. Barr

which peculiarly adapts a motor to a specific service and makes for reliability, we cannot but realize that the buyer is likely to be confused in making his selection on this basis alone. Our company's policy has consistently insisted that this technical superiority must be augmented by continual and intelligent service both before and after the motor is sold. It was as a result of this policy that it was felt that the firm's old name was cold and impersonal and that to be consistent with the policy the name should indicate more of that service which goes with the product—should indicate that a real personality does enter into the output, looking upon that output as including in a very large measure, human thought and service.

Perhaps one factor which led to the adoption of this selling plan in the early days, outside of the natural desire to serve, was the fact that the company made an intensive study of the particular industry it was then selling and it was found that in the specifications for the motors there should enter such questions as rapid motor reversal and the peculiar conditions imposed by the use of centrifugals. There also entered into it the question of the damp atmosphere and even the human element as reflected by the mediocre grade of operating help and, in those early days, the absolute innocence of the public as regards the operation and maintenance of motors in general.

As a result of this intensive study, the volume from this particular industry began to increase very appreciably, which immediately led to the conclusion that the same service in connection with other industries should furnish a very real need. This led to the employment of thoroughly capable men who are capable not only with reference to the electrical part of the equipment which they sell, but also of getting an appreciation of our customers' problems. These men were so chosen and so intimately in touch with our home organization as to warrant an early slogan of the company, "Every salesman is an engineer," and their instructions were to sell not only motors but "service."

Higher Expense Involved

Naturally this type of selling service involves a somewhat higher expense. The company has come to look upon a perfectly definite portion of what is usually called selling expense as being service expense. In other words, it is a certain amount of money invested in the transforming of motors from simple motors to instruments in connection with specific applications.

This policy has also enabled the company to hold high-grade salesmen, because the intimate study of

an industry's requirements and the ultimate solution of its problem is a fascinating type of employement and offers a field that is almost kaleidoscopic in its nature. Continually taking up new industries furnishes a constant opportunity for ingenuity and resourcefulness, and even those industries which have been thoroughly motorized are in a continual state of change and improvement.

Some of these developments lead to a very appreciable investment on the part of our company, and in addition to field tests we have in a number of cases installed the equipment to be driven in our own factory and made observations which included not only the motor but also a detailed study of the driven device. In many cases it has thus become possible to suggest to the manufacturer of the device to be driven modifications which better suited it to motor application.

This type of development makes it necessary for our outside men to study intimately certain industries entirely foreign to our own, and this policy has resulted in our looking upon our outside sales organization as constituting a portion of the engineering department of our customers, with the result that our outside selling organization has developed to a remarkable extent the ability to throw itself into an industry, learning its salient features with particular reference to the application of motors.

Growing Knowledge of Motors

Occasionally we find an industry which determines for itself the general trend which its development is to take, and it is continually a matter of surprise to us to find how intimately industry in general is becoming acquainted with motor characteristics as applied to its particular needs.

A good example of this is the elevator industry. The high-torque motor such as is used for elevator service is not difficult to build, but many of the elevator manufacturers have worked out electrical devices, such as controls, brakes and other auxiliary apparatus, which, though basically electrical, are peculiarly adapted to their particular requirements. The motor manufacturers have done their part by definitely defining the short-time rating required by this industry, thus again transforming a mere motor into an instrument which, in the hands of the elevator manufacturer, is capable of satisfactorily performing the work which it has to do.

Although we do not hesitate to develop very special highly organized machines where these machines are indicated as a result of our studies, it should not be inferred that a detailed study leads to a special machine in all cases. While the industries which, in conference with our salesmen, find they can adopt an absolutely standard motor have done much toward assuring themselves of prompt service in the matter of shipment, we have found it necessary to be very frank with ourselves in not attempting to influence the use of standard motors where special motors should be applied. Such a policy would result only in a temporary advantage in the matter of shipments and would almost certainly react on account of unsatisfactory performance of motors in service.

Production Problems

There is another factor of prime importance to the customer which is often overlooked. The electric motor industry has become quite highly organized from the standpoint of production. Quantity production, however, has its advantages and also its penalties. The advantage of a system of rapid production of duplicate, interchangeable parts gives to the customer motors at comparatively low cost. The disadvantage is that the injection of special mechanical or electrical work becomes a very serious problem because it cannot be economically produced in a shop organized to produce a large percentage of highly standardized output.

A comparatively small organization like our company is fortunate in being able to keep closely in touch with its trade. This is particularly true on account of the intimate contact maintained between our customers and our outside field men as well as the officers of our company at the home organization. As a result of this contact, it is possible to make an analysis each year which indicates pretty accurately the general trend of business, at least so far as our own particular customers are concerned. As a result of this analysis, it is continually a matter of surprise to us to find the extent to which motors are being applied as labor-saving devices. The question of investment in the motors seems to be of comparatively little importance, and we are sometimes astounded at the investment which our customers consider legitimate in order to eliminate a comparatively insignificant amount of labor. Very frequently the application of a motor may make no direct saving in labor, but is warranted on account of increased convenience or even on account of increased safety, or both, in some instances.

An interesting example is the application of motors to window closers in industrial plants. The motors in this case very frequently are in operation only fifteen minutes in a ten-hour day.

From a beginning which developed motors for a particular industry there has been developed through a period of years a policy, not alone in connection with selling but in connection with the whole conduct of business, which looks upon the motor in a much broader sense than as merely an electric motor. It looks upon it as an instrument designed, in collaboration with the man who will use it, to do certain things, built with this duty in mind and sold with a full sense of the permanent responsibility for continued and satisfactory operation.

Bureau of Standards Tested 1,660,000 Lamps Last Year

MORE than 1,660,000 electric lamps purchased by the United States government were inspected by the Bureau of Standards during the fiscal year ended June 30, 1923. Samples of these lamps were tested for candlepower and were then subjected to the life test, which consists in burning the lamps continuously until they burn out. In order to reduce the time required for this test the lamps are burned at a higher voltage than their rated voltage, the relation between their life at this voltage and their life at normal voltage being known.

A total of 1,608 samples were thus tested, these consisting of 1,318 vacuum tungsten lamps, 216 gas-filled tungsten lamps and 74 carbon lamps. During this time the Bureau also tested about 350 samples, representing a number of brands which were submitted to the States of New York and Illinois in competition for state contracts.

Business Conditions

A Survey of Important Developments in the Electrical Market Including Data on Production, the Sales Outlook, Credits, Exports, the Metals and Other Conditions Affecting Cost, Supply and Demand

ALL of the electrical industry, in common with others, is overshadowed this week by the sorrow of national bereavement. Confidence remains unshaken as to the future under President Coolidge, and not a trace of uneasiness is reported in electrical circles as to the probable stability of business development under the administration of the new Chief Executive of the country.

Current orders upon electrical supply jobbers reflect seasonable conditions, but a substantial volume of trade is being handled week by week and the building industry is a continuing heavy buyer of material. Deliveries are slow in porcelain insulators and require considerable anticipation in placing orders for steel products. Little evidence of non-employment is apparent in electrical circles, although in some plants not much is being done in the way of adding to existing personell. Prices were more settled as the week began, with a tendency toward stiffer figures in wiring supply lines. Wire itself is rather weak. Considerable "pick-up" business from central-station companies is being handled by jobbers, but the principal wire market is the building industry.

Excellent Wiring Device Production with Slower Demand

DESPITE some recession in the demand for wiring devices common to this season, an excellent production volume is being handled by leading manufacturers and the outlook for the fall is encouraging. A representative wiring-device maker said last week that his sales are about equal to those of a year ago, although spring business was considerably ahead of the corresponding period of 1922.

Full-time operation is in progress, although additional employees are not being taken on at present. Raw materials are now in excellent supply, barring occasional temporary irregularities in the delivery of porcelain. These cause little real difficulty at present. Wages are firm and raw-material prices recently weakened slightly, resulting in a tendency to pass along the very moderate reduction to the buyer.

Considerable competition for business exists, and this has lately affected prices somewhat, tending toward instability. In well-informed circles the opinion was expressed last week that a plane of price stabilization has now been reached, and jobbers were advised to restock their none too ample supplies of staple wiring devices against the fall demand. Outside New York City there has been a continuing excellent volume of building work under way throughout the country, speaking broadly. Considerable manufacturing for stock is under way, and it is expected that increased movement of these products into the hands of distributors will very shortly be in evidence.

Pole, Truck and Range Active in Atlanta Market

THE Atlanta territory as a whole is experiencing the usual midsummer lull, although all indications point to satisfactory conditions throughout the section in the early fall. Textile plants report difficulty in obtaining orders at this time, but have confidence that buying will be resumed by Oct. 1. The Birmingham district reports a slight falling off in the steel and allied lines, though the cast-iron pipe dealers are still busily engaged on back orders. Agricultural prospects show some improvement, with all indications pointing to a fairly satisfactory, though spotty, cotton crop. Building of houses, apartments and all classes of commercial structures is very heavy, building permits for the entire section being largely in excess of those for a similar period last year.

Jobbers report a very active market for transmission-line material, one of the largest jobbers in the district reporting a 300 per cent increase in sales of cross-arms over their average sales. Poles are also in strong demand, with a growing tendency toward the use of creosoted pine, especially on high-tension transmission-line construction. High-tension insulators are moving satisfactorily, this activity being the natural result of high-tension line construction under way in the larger Southeastern power companies.

Long-continued sales efforts by electric truck manufacturers are beginning to bring results, as evidenced by the closing of orders last month by one dealer for nine trucks in Florida territory.

The successful merchandising efforts of central stations in the Southeast is evidenced by an approximate 40 per cent increase in electric range sales over the same period last year, with prospects that this activity will gain momentum during the fall and early spring months.

Chicago Quotes Armored Cable $42 from Pittsburgh Basing

PROBABLY the most important feature in this week's development of Chicago trade is the announcement of a price of $42 on flexible armored cable from a Pittsburgh basing. This announcement, following the reduction on July 18 to $39, sheds a light on the situation. At the time of making the previous reduction, no consideration apparently was given to the fact that steel had advanced the same week. From an unbiased viewpoint it would appear that the larger manufacturers reduced their prices to bring certain other interests which were demoralizing the market into line. Indications now are that some mutually profitable agreement has been reached.

Chicago is setting a new high record this year both in spending money for building and in obtaining added housing facilities for domestic and commercial uses, according to Oscar Hewitt of that city. The two best previous years were 1922 and 1921. The money spent in the first seven months of these two years compares with the same part of 1923 as follows: 1923, $204,717,912; 1922, $127,716,710; 1921, $66,460,600.

It is estimated that the total for 1923 will be above $260,000,000 as building has been going on at the rate of $320,000,000 for the twelve months. If the city were to keep up only with the last five months of last year, 1923 would total more than $300,000,000.

Believing that building costs have been in some cases too high, which might retard building, certain interests have announced price reductions to stimulate building activity. A boiler company announced in an advertisement a cut in prices and said it was for the purpose of promoting building. Various retail lumber dealers in Chicago about the same time reduced their prices. During the first seven months of this year permits have been issued for 18,178 apartments and residences, as against 15,242 during the same period last year. It is generally admitted that the city needs additional flats, and if building continues at the rate stated, business in the electrical trade should pick up materially during the winter months.

Motor Demand Slows to Normal in Middle West

THE present let-up in the motor business throughout the Middle West after the extended peak demand during the spring is allowing the manufacturers a breathing spell and a chance to get their bearings after the rush of business over many months. In addition, it is allowing production to improve since a definite schedule can now be adhered to in order to clean up the back orders.

This present slump is not creating any annoyance on the manufacturers' part; in fact, this period may be characterized as that following a storm—a welcome calm. The extremely high demand during the spring months was unhealthy since it caused much trouble to manufacturers who tried to explain why their deliveries were not better than eight to thirty weeks, depending upon the size of orders. Such a pyramiding of orders would naturally tend to inflate the demand and supply a market for motors. But the recession during July has to some extent remedied

this situation. Conditions might be said to be approaching normal again.

Business at present is good for this time of the year, which is usually characterized by a slight slump. One manufacturer declared that some of the railroads which had been out of the buying market for some time are now placing their orders. Most of the recent shipments are going to various industries which use them on motorized machinery, such as washing machines, pumps and elevators. There appears to be more of a slump in the demand for the smaller sizes than for the larger.

The price situation remains upon the level established during the middle of July, when readjustments were made regarding the recent recommendation of the Electric Power Club stipulating a 40-deg. motor without any overload rating. This change averaged about 5 per cent, with other changes depending upon the type of motor. These prices will remain unless further advances in the cost of labor and raw materials necessarily boost the present lists.

San Francisco Retail Business Promises to Be Fair

SAN FRANCISCO building permits totaled $3,227,115 for July, 1923, compared with $3,024,036 for July, 1922. Volume of general business is very good, but it is conducted with extreme caution. Retail business is good with encouraging signs for the future, especially in radio and household devices. Prices on the latter are fairly steady, such few changes as have occurred being in nature of whittling to market prices. Heavy factory orders of schedule material and rubber-covered wire have just arrived on the Coast, but little concern is felt over their size. Rubber-covered wire has advanced slightly. The summary for the season shows disappointing slump from pre-season expectations and large stocks left over. Motor business is rather slow, and power and light plants are particularly so.

The Metal Market

ACTIVE demand has been reported for lead with advancing prices. The market for other non-ferrous metals has been quiet. Antimony has registered a definite advance.

Most of the copper producers, it is said, would be willing to meet the market if attractive business were obtainable, but the lack of all interest by consumers continues, and nothing would be gained by cutting prices.

NEW YORK METAL MARKET PRICES

	Aug. 1, 1923 Cents per Pound	Aug. 8, 1923 Cents per Pound
Copper, electrolytic	14.62 to 14.75	14.62½ to 14.75
Lead, Am.S.& R.price	6.25	5.50
Antimony	7.00 to 7.25	7.75
Nickel, ingot	27.00 to 32.00	27.00 to 32.00
Zinc, spot	6.10	6.25
Tin, Straits	39.00	39.00
Aluminum, 98 to 99 per cent	26.00 to 27.00	26.00 to 27.00

Activities of the Trade

Devoted to News of the Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

Approve Habirshaw Plan

The reorganization plan of the Habirshaw Electric Cable Company and its affiliated companies has been approved by three-quarters of the creditors in amount, according to the reorganization committee. The time for filing assents to the plan has been extended until Aug. 15.

General Electric July Bookings

Despite price reductions in various lines this year, bookings by the General Electric Company in July were well ahead of the corresponding month in 1922. There was a decrease compared with previous months, but conditions with the General Electric Company are very good and billings are running at a satisfactory rate.

Western Union Buys 5,000,000 Lb. Copper for Construction

The Western Union Telegraph Company last week purchased 5,000,000 lb. of electrolytic copper at a price said by an official to have been a shade below 14.50 cents. The amount paid and the name of the seller were not disclosed. It was stated that the Western Union has purchased 20,000,000 lb. of copper in the last two years for its main line system and that the latest purchase was not exceptional. The copper will be used in regular construction work and for replacements.

Western Electric Cable Output Increases 22 per Cent

All records in the production of telephone cable are being broken at the Western Electric Company, Chicago. Based on the figures of the first six months of the year, when a total of 11,572,265,000 ft. of the copper wire which forms the communication conductor in the telephone lines was used in the manufacture of cable, it is estimated that the plant's output for this year will be at least 22 per cent greater than that of 1922. More than 23,000,000,000 ft., or about 4,350,000 miles, of copper conductor will be used before the year's shipments are completed. This represents an increase of more than 15,000,000,000 ft. over the amount of copper wire needed for the manufacturing processes of the same plant ten years ago. Production in most of the other branches of telephone manufacture is also being maintained at an extremely high rate.

The year's output of telephone receivers will probably reach the 1,750,000 mark. This is about 500,000 more than the plant turned out in 1922. Orders for new apparatus are pouring in at a rate that indicates that the next twelve months will be about the busiest in Western Electric Company history.

This increase in cable output, paralleling as it does a substantial increase in the production of all forms of telephone equipment, is a reflection of the continuous expansion in the nation's telephone facilities. The foregoing figures indicate how the Western Electric Company as the manufacturing end of the Bell System has been increasing its already great output to keep pace with this continued growth.

Order for 100 Ward Trucks

The Andrew C. Duncan Company, 2835 Washington Avenue, St. Louis, has recently secured an order from the Nafziger Baking Company, St. Louis, for 100 Ward electric trucks, to be used in the bakery's various plants. These trucks are all of ½-ton capacity and are equipped with Edison batteries. The Nafziger Baking Company has plants in Kansas City, Springfield, Mo., Memphis, Tenn., Decatur, Ill., and in several towns in Kansas.

Brandes New Factory Building

C. Brandes, Inc., manufacturer of radio head sets, has just purchased a new factory building containing 46,000 sq.ft. of floor space. This will be operated as a "feeder" plant for other of the firm's factories. The corporation with all its branch factories now occupies 70,000 sq.ft. of space. The executive offices and main plant are at 237 Lafayette Street, New York City.

Westinghouse Iron Essay Contest

The introduction of a new 6½-lb. flat-iron in the Rocky Mountain territory by the Westinghouse Electric & Manufacturing Company has been started with an essay contest, prizes being one-day trips through the "Garden of the Gods" at Colorado Springs, with all expenses paid for the winners and guests invited by them. "The Value of Balance in an Iron" is the subject of the contest, the judges of which will be J. P. Sprunt, Jr., of the Westinghouse Electric & Manufacturing Company; Clyde Osborne of the Mine & Smelter Supply Company, and S. W. Bishop of the Electrical Co-operative League. W. E. Barrett, publicity man for the Westinghouse company in Denver, promoted the idea. Splendid co-operation on the part of the dealers is reported, with a number of attractive window displays being made throughout the city until the conclusion of the contest, Aug. 10.

Tornado Demolishes Large Chimney of Wico Electric Company

The 100-ft. brick chimney of the Wico Electric Company's plant in West Springfield, Mass., completed this year and occupied by the concern only a short time, was demolished by a tornado that mowed a swath through the principal industrial section of the town on Sunday, Aug. 5. Tons of brick were poured through the roof of the main shop, burying benches where employees of the assembly department to the number of twenty or more are working on weekdays. At the same time the force of the storm ripped away parts of the roofs of the Wico group and swept them along with a mass of débris from other buildings. The Wico's loss is estimated by the president, Phelps Brown, at $20,000. This was the only concern hit by the tornado whose insurance policy was written to cover loss by this cause. The management hopes that plant operations will suffer only a brief interruption.

Chicago Jobber Buys New Location

The Inland Electric Company, 14-16 North Franklin Street, Chicago, has purchased the five-story building at 16-20 South Wells Street, which it will occupy as soon as possible. With a frontage of 60 ft. on Wells Street, this building will have a total floor space of 27,900 sq.ft. The building will be divided into locations for lighting fixtures, radio supplies and electrical supplies as soon as the remodeling is completed. One side of the main floor will be devoted to radio while the opposite side will have retail counters.

On the second floor there will be a well-appointed display room of commercial fixtures so that engineers and contractors may have an opportunity to choose their fixtures before building. Part of this second floor will be used for the company's offices. Ample shipping facilities are provided by means of a private alley on the south and rear. This new building will also allow further expansion in taking on stock and acting as manufacturers' distributors. The officers of the company remain the same: President, Herman Larson; vice-president, Edward Stapleton; secretary, H. Steinberg; sales manager, V. T. Jennings.

Whitmore Electric Takes on Several New Lines

The Whitmore Electric Company, 1637 Court Place, Denver, formerly engaged in the distribution and sale of portable farm power plants, has become an exclusive manufacturers' representative in the Rocky Mountain territory. Among the accounts which have been taken on and for which wholesale stocks are being maintained are those of the Sweeper-Vac Company, Springfield, Mass.; Hart-Hegeman, Hartford, Conn.; Grinnell Washing Machine Company, Grinnell, Iowa; Moe-Bridges Fixture Company, Milwaukee, and the Domestic Motors Company, Cleveland. R. F. Whitmore is the general manager.

Heine Boiler Sales Changes

The Heine Boiler Company, St. Louis, announces several changes in sales organization effective Aug. 1, 1923. George F. Murphy, having completed the reorganization of the company's New York office, has taken charge of the Philadelphia territory, with headquarters in the Pennsylvania Building, Philadelphia.

Harold P. Childs, formerly special representative of the executive offices of the General Electric Company, has become associated with the Heine firm as manager of its New York office with headquarters at 11 Broadway.

J. R. Fortune, formerly manager of the Detroit office, has assumed charge of the territories heretofore covered by Pittsburgh, Cleveland and Detroit offices and will maintain offices in the Park Building, Pittsburgh. The Cleveland office has been discontinued.

A. E. S. & M. Company to Enlarge Motor and Transformer Plant

The American Electric Service & Maintenance Company, Springfield, Mass., is about to enlarge its plant for rewinding and redesigning motors and transformers by occupying the old plant of the Wico Electric Company, affording 15,000 additional sq.ft. of floor space adjacent to the present A. E. S. & M. establishment, the building having been acquired by a long-term lease. This structure will be remodeled and equipped with much new machinery.

A. M. Sofield, managing and con-

Edison Lamp Representatives in Conference at Harrison

THIS illustration shows the group attending the July conference of the Edison Lamp Works at Harrison, N. J., during the week of July 16. Two conferences are held during the summer, one in July and one in August. Representatives of "Edison Lamp" jobbers, central stations and district offices spent the first day of the conference in Harrison going through the factory. The rest of the sessions were held at the Newark Athletic Club where lectures were given by members of the different home office departments covering all phases in the lamp business. The entire week was devoted to such instruction. Representatives from all over the country and one from Japan attended this conference.

The August session is known as the "senior conference," and this will be devoted largely to lighting practice, with considerable merchandising and selling instruction included.

trolling owner, says that work on transformers the present year has run 200 per cent ahead of last year, and that repair work has amounted to $20,000 a month, as against $6,000 a month last year, this being in addition to buying and selling transformers and installation work at power stations. The improvements at the plant are to be started immediately, with a view to completion by the first of next year.

King Manufacturing Appoints Sales Manager

Walter T. Wells has resigned his position with the Mountain States Machinery Company of Denver to become sales manager of the King Manufacturing Company, with headquarters in Chicago. Mr. Wells was a street-lighting expert in the Rocky Mountain region, and his new position will provide a much larger territory for activities along the same line.

New Fixture Firm in Denver

The United Electric Company has been incorporated in Denver as an exclusive lighting fixture and accessory manufacturer's agency, with complete stocks to be carried in that city. W. J. Keating, formerly of the Electrical Supply & Construction Company of Denver, is president and manager of the new organization. Temporary headquarters are being maintained at 3890 Zenobia Street until satisfactory offices can be secured in a downtown building.

"Universal" Iron Campaign

Every week, on Monday, throughout July and August, Landers, Frary & Clark, New Britain, Conn., are running advertisements for their "Universal Wrinkleproof" irons in a selected list of newspapers in sixty cities. Officials of the company say that this extended advertising is being carried on this year because of the great enthusiasm aroused during the "spring iron campaign."

The Almetal Manufacturing Company, Inc., 7227 Manchester Avenue, St. Louis, announces the appointment of A. W. Lindgren as general sales manager to succeed N. D. Thompson, resigned. H. L. Draper, 280 Broadway, New York City, has been appointed the company's Eastern representative.

The Tubular Woven Fabric Company, Pawtucket, R. I., announces the resignation of Walter C. Rardin as district sales manager in the Chicago territory. William R. Collins, formerly with the Packard Lamp Division, has been appointed to succeed Mr. Rardin. The Chicago office has been changed to 1524 South Western Avenue.

The Sherwin-Williams Company, Cleveland, has appointed L. F. Mullen as sales insulation engineer for the Eastern district.

Harmer, Inc., New York City, recently incorporated for $100,000, announces that it will manufacture arc lamps and other electrical equipment. The company is now manufacturing some lines in Long Island City, but hopes to establish a plant in New York City at an early date. Further plans will be announced later. C. S. Ashley, 120 Liberty Street, New York City, is representative.

The Macbeth Daylighting Company, New York City, recently incorporated for $10,000 with permission to increase to $500,000, is a reorganization of the Artificial Daylighting Company, 227 West Seventeenth Street, manufacturer of lighting equipment and fixtures. A change in the offices of the company will be announced later.

The Wayman Electric & Manufacturing Company, East Palestine, Ohio, expects to erect a new factory building this fall.

The Radiant Electric Company, Massillon, Ohio, recently incorporated with capital stock of $25,000, will manufacture electric heating appliances, including electric ranges.

The Vaco Washer Company, Sabina, Ohio, has been incorporated with a capitalization of $10,000 to manufacture electric washing machines. The plant will be in Sabina and production is expected to start some time in August. R. W. Allen is president of the company.

The Conlon Corporation, Cicero, Ill., manufacturer of electric washing machines, announces the appointment of the Woodill & Hulse Electric Company, Inc., Los Angeles, as its distributor in southern California.

The International Electrical Supply Company, Inc., New York City, recently organized with $25,000 capital stock, will manufacture electrical fixtures.

A. H. Peacock, Inc., Queens County, New York, recently incorporated with capital stock of $10,000, will manufacture electrical fixtures.

Kaylite Manufacturing Company, New York City, recently organized with capital stock of $20,000, will manufacture electrical fixtures.

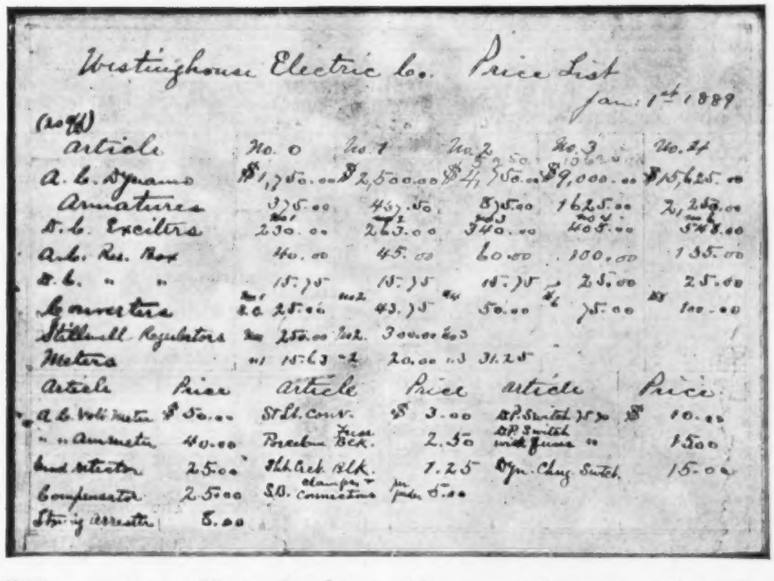
The Okonite Company, 501 Fifth Avenue, New York City, manufacturer of insulated wire and cables, with plant at Passaic, N. J., is disposing of a note issue of $600,000, a portion of the proceeds to be used for additions to working capital, expansion, etc.

The Bristol Company, Waterbury, Conn., manufacturer of recording instruments, has awarded a contract for the erection of its proposed new plant at Platts Mills. It will be a one-story building, 50 ft. x 100 ft., estimated to cost $50,000. Work will be placed under way at once.

The Star Porcelain Company, Muirhead Avenue, Trenton, N. J., manufacturer of electric porcelain products, has completed plans for the erection of a new one-story addition and will break ground at once.

The Western Electric Company has leased the twentieth floor and other space in the new Pershing Square Building, New York City, at an aggregate rental of $750,000. Immediate possession of the premises will be taken and used by the lessee for its sales organization, now at 195 Broadway.

Westinghouse First Price List in 1889


Westinghouse Electric Co. Price List
Jan. 1st 1889

Article	No. 0	No. 1	No. 2	No. 3	No. 4
A. C. Dynamo	$1,750.00	$2,500.00	$4,350.00	$9,000.00	$15,625.00
Armatures	375.00	437.50	875.00	1625.00	2,187.50
S. C. Exciters	250.00	262.50	350.00	405.00	543.00
A.C. Rec. Box	40.00	45.00	60.00	100.00	135.00
S. C. " "	15.75	15.75	15.75	25.00	25.00
Converters	20.25.00	43.75	50.00	75.00	100.00
Stillwell Regulators	250.00	300.00			
Meters	15.63	20.00	31.25		

Article	Price	Article	Price	Article	Price
A.C. Voltmeter	$ 50.00	St'd. Conv.	$ 3.00	D.P. Switch	$ 10.00
" " Ammeter	40.00	Brecken Rect.	2.50	D.P. Switch with fuses	15.00
Hand Exciter	25.00	Slate Rheostat	7.25	Dyn. Chg. Switch	15.00
Compensator	2.50.00	S.C. clamp connector	per pair 5.00		
Shunting Rheostat	5.00				

THE accompanying illustration shows a price list of the Westinghouse Electric & Manufacturing Company dated Jan. 1, 1889, which is really the first Westinghouse catalog. It lists five alternators with the necessary auxiliary equipment for lighting service. Only the 500, 750, 1,500 and 3,000 light machines were being made at that time, the No. 4 unit still being "on paper." A catalog of supply apparatus recently issued by the same company contains 1,300 pages. This gives a good idea of the growth of the electrical industry. Only fourteen supply systems are listed on the price list of 1889.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

Purchase is desired in Hongkong, China (No. 7,368), of motors, 5 hp. to 50 hp., generators and fans.

Purchase is desired in Tokyo, Japan (No. 7,366), of radio receiving sets and of ice-making machines.

An agency is desired in Mexico City, Mexico (No. 7,391), for radio receiving sets and parts.

An agency is desired in Marseilles, France (No. 7,392), for ice-making machines.

PROPOSED NEW ELECTRIC PROJECTS IN INDIA.—A number of power schemes are under consideration in India, *Commerce Reports* states, including the Nilgiri Hills hydro-electric project, which is to supply electricity to the towns of Coibmatore, Octacamund, Coonoor and Wellington, the work to be completed by October, 1924; the project at Cochin of the Crompton Engineering Company; a license for the supply of electricity, which has been granted to G. Ramachandra Chetty and others covering the town of Bellary, and the plan of Best & Company, Madras, to supply electricity to the municipality of Bezwada. A license to supply energy to the town of Madura was also granted to Best & Company, who are now seeking electrical equipment for this installation.

THE VICTORIA FALLS & TRANSVAAL POWER COMPANY, Ltd., Johannesburg, Transvaal, South Africa, has petitioned the Electricity Control Board, according to Commerce Reports, for an amendment to its license in order that it may construct a new power station on the Witbank coal fields. The cost of the station with transmission lines is estimated at about $5,000,000. It has been announced that one of the engineers of the company, who has left South Africa for London and the United States, will place orders for equipment needed for this development. One copy each of blue prints, plans, and a schedule showing the general scope of this proposed work has been sent to the Bureau of Foreign and Domestic Commerce, Washington, D. C., which may be obtained on loan on application to the Electrical Equipment Division at Washington or any of the Bureau's districts by referring to file No. 97,998.

New Apparatus and Publications

CREAM WHIPPER.—The Wisconsin Electric Company, Racine, Wis., has developed a cream whipper, "Dumore," for use in hotels, restaurants and soda fountains.

WATER HEATING UNIT.—The Arthur-Fowler Company, 119½ North Browne Street, Spokane, Wash., has placed on the market a water heating unit with heat-resisting cover, known as the "A. & F. Fibreform."

REFRIGERATING OUTFIT.—The Baker Ice Machine Company, Inc., Omaha, Neb., is manufacturing a refrigerating unit for use by butchers, creameries, florists, hospitals, hotels, etc.

PORTABLE ELECTRIC PLANT.—The Simms Magneto Company, East Orange, N. J., has developed a small portable electric light and power plant for use on the farm or the home.

HEADLIGHT.—A drum type headlight, Model 19B, with a removable door and back, has been developed by the Kilborn-Sauer Company, Fairfield, Conn.

ELECTRIC RIVET HEATER.—The American Car & Foundry Company, Berwick Heater Division, 165 Broadway, New York City, has placed on the market an electric rivet heater.

ELECTRIC INDUSTRIAL HEATING INSTALLATIONS.—Special publication No. 1,667, containing a list of more than 300 installations of Westinghouse industrial heating apparatus, has been issued by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. This list, which contains only the more important installations, gives a definite idea of the extent to which electricity is being used for industrial heating purposes.

AUTOMOBILE STOP SIGNAL.—The Tell-Stop Appliance Company, 1379 West Twenty-fifth Street, Cleveland, has placed on the market a "Tell-Stop" signal equipped with a dash-board indicator which operates simultaneously with the rear "Stop" light and indicates to the driver whether or not the rear signal is working.

ICE SCORING MACHINE.—The Artic Ice Machine Company, Canton, Ohio, is manufacturing an electric ice-scoring machine.

TRANSFORMER TEMPERATURE SIGNAL.—The Packard Electric Company, St. Catharines, Ontario, Canada, has placed on the market the "Packard" transformer temperature signal. This device, by mistake, was credited to the Packard Electric Company, Warren, Ohio, in the issue of July 7.

POLYPHASE MOTORS.—The Robbins & Myers Company, Springfield, Ohio, has placed on the market its new type "L" polyphase motor, which will be manufactured in sizes ranging from ¾ hp. to 150 hp. Details on this line of motors are given in bulletin No. 135.

MOTOR STARTING SWITCHES.—The Trumbull Electric Manufacturing Company, Plainville, Conn., is distributing supplementary pages for bulletin No. 4 in which it describes its new "Circle T" motor starting switches with overload protection and under voltage release.

REFLECTORS.—The National X-Ray Reflector Company, 235 West Jackson Boulevard, Chicago, has brought out three junior sizes of "X-Ray" reflectors, known as the No. 3 "Mill" type, for use in factories; No. 7 "Scoop Jr." for lighting low deep windows, and No. 11 "Hood Jr." for use in low shallow windows. The company is distributing a four-page leaflet calling attention to the story of the "X-Ray Gallopin Dominos."

THEATER LIGHTING—The Ward Leonard Electric Company, Mount Vernon, N. Y., is distributing a booklet entitled "Theater Lighting Past and Present," in which it presents the development, construction and the use of the "Ward Leonard" theater lighting control system. It also includes a brief outline of the history of theater lighting.

ELECTRIC BOTTLE WASHER.—The Electric Specialty Company, Stamford, Conn., is distributing a leaflet covering its new "Esco" electric bottle washer and general household motor combined in one unit.

GRINDING AND BUFFING MACHINE.—The Hisey-Wolf Machine Company, Cincinnati, Ohio, is distributing bulletin No. 3014-S describing the "Hisey" motor-driven combination grinder and buffer.

INSULATED COUPLINGS.—"Flexible Insulated Coupling," is the title of booklet "F" issued by the Charles Bond Company, 617 Arch Street, Philadelphia, covering its "Grundy" flexible insulated couplings and the "Mather" couplings.

ELECTRIC FLATIRON.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has brought out a new model "Westinghouse" electric iron.

ELECTRIC METER.—An electric CO_2 instrument has been developed by the Bacharach Industrial Instrument Company, 7000 Bennett Street, Homewood Station, Pittsburgh. This device may be furnished either indicating or recording, or an indicating or recording CO_2 attachment can be furnished for it.

INSTRUMENTS FOR RADIO CONTROL PANELS.—The Roller-Smith Company, 233 Broadway, New York City, is distributing bulletin No. 10, covering the "Roller-Smith" small-size instruments for radio control panels.

STOKER.—Bulletin CB2 issued by the Combustion Engineering Corporation, 43 Broad Street, New York City, describes and illustrates the "Coxe traveling-grate stoker."

New Incorporations

THE LOST RIVER ELECTRIC COMPANY, Bowling Green, Ky., has been incorporated by W. H. McCampbell, H. V. Taylor and others. The company is capitalized at $1,650.

THE McBAINE ELECTRIC TRANSMISSION COMPANY, Columbia, Mo., has been incorporated by W. W. Riggs, E. J. Douglass and others

THE VIRGINIA-CAROLINA POWER COMPANY, Richmond, Va., has been granted a charter with a capital stock of $500,000 to distribute electricity in Brunswick and Mecklenburg Counties, Va., and in Warren County, N. C. The officers are: Marvin Smithey, Lawrenceville, Va., president; Whitney D. Meredith, Lawrenceville, vice-president, and William Gray, Richmond, secretary.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

BOSTON, MASS.—Plans are being prepared by the Fire Department for the construction of a fire-alarm station on Hemenway Street, to cost about $200,000. T. M. Glynn is fire commissioner.

LEOMINSTER, MASS.—The Leominster Electric Light & Power Company is planning to erect a new substation in North Leominster. A new 13,000-volt transmission line is being erected from the Mechanic Street station to the site of the proposed substation.

WORCESTER, MASS.—The State Department of Public Utilities has approved the petition of the New England Power Company for permission to erect an electric transmission line across the Wendell State Forest. This line is to be built in connection with the construction of a 75-mile transmission line from the hydro-electric plant being erected by the company at Whitingham, Vt., to a substation at Millbury, Vt.

WOONSOCKET, R. I.—The Blackstone Valley Gas & Electric Company will build a one-story substation, 100 ft. x 120 ft., on West Park Place, to cost about $50,000.

WOONSOCKET, R. I.—The Rathbu. Knitting Company will build a one-story power house at its mill on North Main Street, 40 ft. x 45 ft.

GLENBROOK, CONN.—The Norma Company of America, Inc., Anable Avenue Long Island City, N. Y., contemplates the construction of a substation at its plant to be erected at Glenbrook, to cost about $80,000. Francisco & Jacobus, 511 Fifth Avenue, New York, are architects.

HARTFORD, CONN.—The Hartford Electric Light Company will build an addition to its South Meadows generating plant to double the present capacity. Contracts for a portion of the equipment have been awarded. Extensions will be made in the transmission system.

Middle Atlantic States

BUFFALO, N. Y.—Electric power equipment will be installed in the proposed two-story baking-plant addition to be erected by the Egloff Bakery, Inc., 147 Genesee Street, to cost about $75,000. L. S. Beardsley, 116 West Thirty-ninth Street, New

ITHACA, N. Y.—The New York State Gas & Electric Corporation has petitioned the Public Service Commission for permission to extend its system to Laurens, Exeter and Otsego to supply electrical service.

NEW BRIGHTON, N. Y.—The Staten Island Edison Corporation now being organized to take over and operate the electric division of the Richmond Light & Railroad Company, contemplates extensions and improvements in the property. J. H. Pardee, president of the existing company, will head the new company.

LANCASTER, N. Y.—The Depew & Lancaster Light, Power & Conduit Company has issued 25,000 shares of capital stock, part of the proceeds to be used for extensions and improvements.

NEW YORK, N. Y.—The Mesabi Iron Company, 25 Broad Street, plans to install electric power equipment at its plant in connection with new sintering works to cost about $1,500,000.

PHILLIPSTOWN, N. Y.—The Central Hudson Gas & Electric Company is negotiating for the purchase of the capital stock of the Phillipstown Electric Corporation, recently formed by local residents to secure electrical service. If the stock is acquired, the Central Hudson company will erect a transmission line and distributing system here and will furnish electricity from the Poughkeepsie plant.

WINDHAM, N. Y.—The Valley Electric Company has applied to the Public Service Commission for permission to extend its system into Ashland and Prattsville Townships to furnish electricity for light and power.

NEWARK, N. J.—Electric power equipment will be installed in the proposed ice-

manufacturing and cold-storage plant to be built by the Associated Utilities Company, care of William Braun & Company, 30 Church Street, New York, engineers, to cost about $1,000,000.

BEDFORD, PA.—The Bedford Rustic Furniture Company plans to construct a power house at its proposed local plant, to cost about $75,000.

FRANKLIN, PA.—The Venango Public Service Corporation has secured permission to purchase and merge twenty-three light and power companies operating in Venango County, including Beaver, Knox, Salem, Washington and Mill Creek Townships, and at Shippenville, Edenburg, Emlenton and Clintonville. Extensions and improvements are planned.

MILLVILLE, PA.—The Greenwood Light & Power Company, a subsidiary of the Pennsylvania Power & Light Company, will take over and operate the Millville Electric Company. Extensions will be made in the transmission system.

MOSCOW, PA.—The Moscow & Roaring Brook Electric Company, recently organized, proposes to construct a transmission line and install a distributing system in Roaring Brook Township.

PHILADELPHIA, PA.—Delany & Company, Milnor and Cottman Streets, manufacturers of glues, adhesives, etc., plan to rebuild their power house and plant, recently destroyed by fire, causing a loss of about $400,000.

PHILADELPHIA, PA.—The Board of Trustees, University of Pennsylvania, is planning to construct a power house at the institution, to cost about $45,000.

PHILADELPHIA, PA.—The Viscose Company, Marcus Hook, Pa., plans to construct a power house at its proposed artificial silk mills in the Tacony-Holmesburg section, to cost about $2,500,000.

PHILADELPHIA, PA.—A number of utility companies are being organized by R. Van Horn and C. Schubert, Philadelphia, to construct and operate transmission and distributing systems, the companies taking their names from the respective township, as follows: Decatur Township, West Township, Lincoln Township, Spruce Hill Township, Frank Township, West St. Clair Township, East Providence Township and Uni Township Power companies. James C. Jones, Bullitt Building, is representative.

PITTSBURGH, PA.—The West Penn Power Company has secured permission to take over and merge the following companies in Butler County: Bruin, Fraser, Queenstown, Wayne, Springfield and Cowanshannock Township Electric corporations and Karns City Borough Electric Company. Extensions and improvements are planned.

MARTINSBURG, W. VA.—The West Virginia Transmission Company, recently incorporated, plans to erect a transmission line from the new power plant at Williamsport, Md., to Cumberland, Md., to connect with the system of the American Water Works & Electric Company.

NORFOLK, VA.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Aug. 28 for seventy electric soldering irons for use at the local navy yard. (Schedule 1159.)

WASHINGTON, D. C.—Bids will be received by the General Purchasing Officer, Panama Canal, until Aug. 21 for electric cable, electric wire, electric fixtures, and other electrical and mechanical equipment. (Circular 1549.)

North Central States

DETROIT, MICH.—The Fisher Body Corporation will build a one-story power plant at its automobile body works, Trombley Street, to cost $50,000.

DETROIT, MICH.—The Detroit Connecting Railway, Dime Bank Building, contemplates building an electric railway (88 miles long) from Delray connecting Ecorse, Pontiac, Sylvan Lake Village, Mount Clemens and Marine City. G. H. Kimball, Sr., Pontiac, is chief engineer.

LANSING, MICH.—Electrically operated pumping machinery will be installed in connection with extensions and improvements to the municipal waterworks, to cost about $600,000. Otto Eckert is city engineer.

MOUNT PLEASANT, MICH.—The installation of a new street-lighting system is under consideration by the City Commission.

BELLEVUE, OHIO.—The installation of an ornamental lighting system in the business section is under consideration by the City Council.

BEXLEY, OHIO.—The Village Council has adopted a resolution providing for the installation of an ornamental lighting system to be installed before Jan. 1. The plans call for ornamental standards with 400-cp. lamps maintained by underground wires.

MASSILLON, OHIO.—The Ohio Public Service Company contemplates building a 30,000-kw. substation on Jarvis Avenue, to cost about $150,000.

TOLEDO, OHIO.—Plans are under consideration for the construction of a power plant at the Toledo Hospital, to cost about $80,000. P. W. Behrens is superintendent.

DANVILLE, KY.—The installation of electrically operated pumping machinery at the municipal waterworks is under consideration. Peare, Greeley & Hansen, 38 West Adams Street, Chicago, are engineers.

EVANSVILLE, IND.—Electrically operated pumping machinery will be installed in the municipal waterworks in connection with extensions and improvements to cost $270,000.

INDIANAPOLIS, IND.—The Indianapolis Light & Heat Company will make extensions and improvements, including the installation of a turbo-generator and auxiliary equipment in its generating plant on Kentucky Avenue. A new substation will be built in the Broad Ripple section. Extensions will be made in the transmission system. The work will be carried out in connection with an improvement program to cost $1,500,000.

CHICAGO, ILL.—The Board of Education will install two electric equipment shops in the new Theodore Roosevelt High School to be erected at Wilson and Leland Streets, to cost about $4,000,000. J. C. Christensen, 640 South Clark Street, is architect.

DECATUR, ILL.—The Illinois Power & Light Company, People's Gas Building, Chicago, contemplates building a power plant on Lake Decatur, to cost about $5,000,000. W. E. Baehr is vice-president and general manager.

ELGIN, ILL.—The Chicago, Aurora & Elgin Railroad Company is reported to have acquired a site on Grove Avenue on which it proposes to erect a substation, to cost about $160,000.

EAU CLAIRE, WIS.—The Dells Paper & Pulp Company is planning to build a 6,000-hp. power plant.

GLEN FLORA, WIS.—The citizens have voted to establish an electric light and power service. It is not yet decided whether to install a municipal electric plant or to connect with the transmission system of a private company.

GRANVILLE, WIS.—The Milwaukee Electric Railway & Light Company is planning to extend its 122,000-volt transmission line from Granville to Plymouth.

HARTFORD, WIS.—The installation of an ornamental lighting system is under consideration by the City Council.

MARINETTE, WIS.—The City Council is considering plans for the installation of an ornamental lighting system.

OLIVER, WIS.—The voters have authorized the installation of an electric light and power system. The Village Board is considering the establishing a municipal plant, or it may make arrangements with a private company to extend its lines here. Oliver has not a post office.

PORT WASHINGTON, WIS.—The Municipal Electric Light and Water Department has entered into a contract with the Milwaukee Northern Electric Railway Company for electricity for a period of one year to provide for the increasing demand for electrical service. If the arrangement is satisfactory, a ten-year contract will be made for additional energy.

WAUSAU, WIS.—The Wisconsin Valley Electric Company has applied to the State Railroad Commission for permission to issue $500,000 in capital stock, the proceeds to be used for extensions and improvements.

WEST ALLIS, WIS.—The installation of an ornamental lighting system on Sixty-eighth Avenue is under consideration by the City Council.

CLOQUET, MINN.—The Phœnix Utilities Company, Lyceum Building, Duluth, acting for the American Power & Light Company, has acquired several power plants and appropriated funds for the construction of new power dams at Cloquet and near Lake Vermilion. The cost of the entire project, including extension of feed lines, is estimated at $7,000,000. W. S. Robertson, care of Phœnix Utilities Company is engineer in charge.

MINNEAPOLIS, MINN.—The First National Bank, Fifth Street and Marquette Avenue, has authorized plans for extensions and improvements in its power plant to cost about $35,000. G. M. Orr, 516 Andrus Building, is engineer.

ST. LOUIS, MO.—The Union Electric Light & Power Company has acquired the properties of the Light & Development Company, which will be merged with the Union system. Extensions and improvements will be made.

DUNCAN, NEB.—The erection of a transmission line to supply electricity for municipal service is under consideration.

COLUMBUS JUNCTION, IOWA.—The Iowa Gas & Electric Company, Washington, has purchased the property of the Louisa County Power Company.

HAVERHILL, IOWA.—The Haverhill-Laurel Electric Company is planning to build an electric distributing system in Haverhill and Laurel and a transmission line to connect with the system of the Iowa Railway & Light Company at Marshalltown.

VILLISCA, IOWA.—Bonds to the amount of $75,000 have been voted for the installation of a municipal electric and power plant. The Iowa Service Company, Omaha, Neb., which furnishes electricity here, is erecting a new transmission line from Red Oak to Villisca. A new line is also being erected from Clarinda to Villisca to connect with the Red Oak station.

STOCKTON, MO.—The Stockton Light & Power Company has rejected bids received for the construction of a hydro-electric power plant on the Sac River. Revised plans will be drawn and new bids called in the near future. Russel & Axon, 404 McDaniel Building, Springfield, Mo., are engineers.

UNION STAR, MO.—George H. Durant, owner of the local power plant, contemplates extensions and improvements, to cost about $30,000.

DUNCAN, NEB.—The voters have authorized the installation of an electric distribution system. Electricity will be obtained from the Columbus (Neb.) Light, Heat & Power Company.

OMAHA, NEB.—Plans are under way by the Nebraska Power Company for the construction of a new substation at Twentieth and Howard Streets, to replace the temporary station and to cost about $600,000. The work includes the revamping of the direct-current elevator service.

RICHLAND, NEB.—Bonds to the amount of $10,000 have been voted for the installation of an electric distributing system. Electricity will be secured from the Columbus (Neb.) Light, Heat & Power Company.

SNYDER, NEB.—Bonds to the amount of $90,000 have been voted for the installation of a municipal electric light and power plant.

WICHITA, KAN.—The Red Star Mill & Elevator Company plans to construct a new power plant on North Emporia Street, to cost about $30,000.

TOPEKA, KAN.—The City Commission is considering the installation of ornamental lamps on Quincy Street and East Eighth Avenue, covering five blocks.

Southern States

CHARLOTTE, N. C.—The Southern Public Utilities Company plans to rebuild its power plant on the South Boulevard, recently damaged by fire, causing a loss of about $50,000.

ELIZABETH CITY, N. C.—Plans are being considered for municipal improvements, including the installation of a municipal electric light plant, waterworks and street paving, to cost about $300,000. J. J. Bray is city manager.

HIGH POINT, N. C.—The High Point Furniture Company is planning to install a generator and auxiliary equipment at its power plant.

HIGH POINT, N. C.—Bids will be received by the Mayor and Council until Aug. 22 for improvements to the sewerage system, including the construction of three sewage-pumping stations, each complete with receiving reservoir, building and duplicate motor-driven pumping units, etc. William C. Olsen, Kinston, N. C., is consulting engineer. A. E. Taplin is city engineer.

MOCKSVILLE, N. C.—The Council has awarded contract to the Electrical Construction Company for the installation of an electric plant, to cost about $15,000.

SHARPSBURG, N. C.—The Council is considering an issue of $10,000 in bonds for extensions to the electric lighting system.

SPARTANBURG, S. C.—The South Carolina Gas & Electric Company contemplates extensions to its hydro-electric plant at Gaston Shoals, to cost about $200,000.

PANAMA PARK, FLA.—The installation of an electric lighting system in Panama Park is under consideration. It is proposed to secure the service from the municipal electric plant at Jacksonville.

LEBANON, TENN.—The Lebanon Woolen Mills contemplate an addition to power house in connection with mill extensions to cost about $100,000. D. W. Southgate, 150 Fourth Avenue, Nashville, Tenn., is architect.

CHATTANOOGA, TENN.—The Tennessee Electric Power Company is preparing plans for its proposed plant extensions, including a 20,000-hp. addition to the hydro-electric plant at Great Falls, 27,000-hp. addition to the power plant at Hales Bar, and 17,000-hp. addition to the auxiliary steam power station at Nashville.

CRAB ORCHARD, TENN.—The Southland Portland Cement Company, Nashville, Tenn., recently organized, plans to construct a power plant in connection with a local cement mill, to cost about $600,000. Benjamin L. Ireland, Nashville, heads the company.

JACKSONVILLE, TENN. — The M-B Automotive Corporation, Jacksonville, Tenn., recently organized, plans to build a power house at its proposed automobile manufacturing plant, to be erected at the Old Hickory powder works of the government. Guy Hamilton is vice-president.

KNOXVILLE, TENN. — The Knoxville Power & Light Company has filed an amendment to its application to make preliminary surveys for power development on the Clinch River with the Federal Power Commission, to enable it to make similar surveys on the Tennessee River at points known as Coulter Shoals and Marble Bluff.

BIRMINGHAM, ALA. — The Alabama Power Company is preparing plans for the construction of its proposed hydro-electric plant at Chewkee Bluffs, to cost about $5,000,000.

WETUMPKA, ALA.—The Alabama Power Company, Birmingham, contemplates erecting a transmission line to Wetumpka and a substation in East Wetumpka.

ABILENE, TEX.—The West Texas Utilities Company is asking for bids for rebuilding and electrifying the Roby & Northern Railroad (12 miles) recently purchased. New rolling stock is to be purchased and a station erected at Roby. The cost is estimated at $100,000. P. Campbell is chief engineer.

HOUSTON, TEX. — The Southern Cartridge Company contemplates building a power house at its proposed local plant, to cost about $200,000. W. C. Nunn is president.

Pacific and Mountain States

BELLINGHAM, WASH. — The Roche Harbor Lime Company plans to rebuild its plant and power house, recently destroyed by fire, causing a loss of about $750,000.

RIDGEFIELD, WASH. — The Bratlie Brothers Mill Company plans to rebuild its mill and power house, recently damaged by fire, causing a loss of about $100,000.

MEDFORD, ORE.—The California Oregon Power Company has applied to the State Engineer for permission to build a hydro-electric plant with an initial output of 9,500 hp.

RAINIER, ORE. — The Jacobson-Reid Lumber Company plans to construct a power house at its proposed local mill, to cost about $80,000.

ALHAMBRA, CAL. — An ordinance is being arranged for the installation of an ornamental lighting system on portions of Primrose, La France, Fremont and Palm Avenues, Huntington Drive, and other streets.

EMERYVILLE, CAL. — The Standard Underground Cable Company, First National Bank Building, San Francisco, is planning to erect a local plant, including a main building, power house and a warehouse, to cost about $200,000. A. Prack, Westinghouse Electric & Manufacturing Company, Emeryville, is engineer.

LOS ANGELES, CAL.—The California-Hawaiian Sugar Refining Company plans to construct a power house at its proposed refining plant in the Wilmington section, to cost about $350,000.

ORANGE, CAL.—The installation of ornamental street lamps on North Cambridge Street, to cost about $2,500, is under consideration.

SAN BERNARDINO, CAL.—The Southern California Edison Company plans to erect a warehouse and pole-treating plant on I Street, to cost about $55,000.

SAN BERNARDINO, CAL.—The Atchison, Topeka & Santa Fé Railway Company will install electric power equipment in connection with extensions in its local car and locomotive shops, to cost about $2,500,000.

SAN FRANCISCO, CAL.—The Kroehler Manufacturing Company, 1319 South Michigan Avenue, Chicago, proposes to build a power house in connection with its new furniture manufacturing plant for Pacific Coast trade, to cost about $850,000.

SAN FRANCISCO, CAL.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Aug. 31, for eighty-four electric outlets for use at the Mare Island navy yard (Schedule 1156); also, until Aug. 21, for six testing generators for the same yard (Schedule 1158).

SANTA ANA, CAL.—Plans are under consideration for the installation of an ornamental lighting system on Broadway between First Street and the northern terminus.

WOODLAND, CAL. — Plans have been prepared by the Pacific Gas & Electric Company, San Francisco, for the erection of warehouse, shops and office building here, to cost about $40,000.

MESA, ARIZ.—Work is progressing on the new power site on the Eastern Canal several miles below Mesa for the power plant of the Water Users' Association. The new site is to take the place of the one situated on the South Consolidated Canal, in the same neighborhood, which was rendered useless by the diversion of the water into the Eastern Canal. It is expected that the power plant will be completed and the machinery removed from the old site during the fall months.

DENVER, COL. — Extensions and improvements are contemplated to the water works system, including the installation of a 10,000,000-gal. steam-turbine-driven centrifugal pump at the Capitol Hill station, to cost $14,210; a 4,000,000-gal. electric motor-driven centrifugal pump at University Park pumping station, to cost $2,945, and an 8,000,000-gal. electric motor-driven centrifugal pump at Ashland Avenue station, to cost $4,820. A. K. Vickery is city engineer.

Electrical Patents

Announced by U. S. Patent Office

(Issued July 17, 1923)

1,462,132. ELECTRIC LIGHTING FIXTURE; H. W. Cordingly, Fredericksburg, Ohio. App. filed Aug. 26, 1922. Ceiling pan.

1,462,207. BATTERY LAMP; E. J. McEachron, Madison, Wis. App. filed Aug. 10, 1921. Hand flashlight.

1,462,209. UNIVERSAL CONDUIT BOX; F. J. Miner, Detroit, Mich. App. filed Jan. 27, 1919.

1,462,224. ELECTRIC COOKER AND MELTING POT; H. C. Bausert, Brooklyn, N. Y. App. filed Feb. 28, 1922. Two heating elements.

1,462,226. INHERENTLY REGULATED DIRECT CURRENT DYNAMO; H. Charlet, Krefeld, Germany. App. filed July 8, 1920.

1,462,251. SEQUENCE SWITCH; F. M. Slough, Rochester, N. Y. App. filed May 8, 1918. For automatic telephone systems.

1,462,252. TELEPHONE SIGNAL ALLOTTING SYSTEM; J. A. Taggart, Rochester, N. Y. App. filed Jan. 24, 1918. Auxiliary signal appears before operator only when she is idle and ready to answer call.

1,462,322. COFFEE MAKING OR BREWING MACHINE; V. Casoletti, Turin, Italy. App. filed Nov. 3, 1920. Electrically heated.

1,462,337. ELECTRICAL INSTRUMENT; C. I. Hall, Fort Wayne, Ind. App. filed April 13, 1920. Maximum demand indicator.

1,462,346. PROTECTIVE DEVICE FOR ELECTRICAL APPARATUS; C. H. Kline, Pittsfield, Mass. App. filed Feb. 16, 1921. High-voltage bushing for transformers.

1,462,350. ELECTRIC STEAM BOILER; W. L. Merrill and H. A. Winne, Schenectady, N. Y. App. filed Feb. 15, 1922. Three-phase boilers.

1,462,354. SPEED CONTROL FOR MACHINE TOOLS AND THE LIKE; B. S. Pero, Schenectady, N. Y. App. filed Oct. 4, 1921. Two-speed control for planers.

1,462,368. TELEPHONE REPEATING SYSTEM; M. Latour, Paris, France. App. filed April 28, 1923. Two-way amplifying system.

1,462,380. ELECTRIC HEATER; E. H. Richardson, Ontario, Cal. App. filed April 2, 1920. Reflector type.

1,462,392. ELECTRIC HEATER; E. C. Strickland, San Jose, Cal. App. filed Feb. 9, 1922. Pleating iron such as is used in laundries.

1,462,421. ELECTROLYTIC TREATMENT OF METALLIFEROUS MATERIALS CONTAINING METALS OF THE CHROMIUM GROUP; R. E. Pearson, London, and E. N. Craig of Ham Common, England. App. filed June 1, 1922.

1,462,431. ELECTRICALLY HEATED TOOL; E. A. Wagner, Fort Wayne, Ind. App. filed Dec. 5, 1921. Soldering iron.

(Issued July 24, 1923)

1,462,525. ARRANGEMENT FOR PRODUCING COMPLEMENTARY VISUAL AND AUDIBLE EXHIBITIONS; G. K. Thompson, Maplewood, N. J. App. filed April 11, 1922.

1,462,526. COMPOSITE RINGER SET; J. F. Toomey, New York, N. Y. App. filed Dec. 31, 1920. For telephone lines.

1,462,572. CONDENSING WELDING CIRCUIT; J. H. Gravell, Elkins Park, Pa. App. filed June 25, 1920. Power factor of welding machine increased by built-in condenser.

1,462,580. METHOD OF MANUFACTURING ELECTRIC CONDUCTORS; R. Rüdenberg, Berlin-Gruenwald, and A. Finckbeiln, Charlottenburg, Germany. App. filed Dec. 27, 1920. Coils for rotating machine.

1,462,586. SHUTTLE-BALANCING MECHANISM; E. C. Taylor, Longmeadow, Mass. App. filed Nov. 3, 1922. For wrapping annular objects such as coils of wire or tire casings.

1,462,612. COVER PLATE FOR STORAGE BATTERIES; A. H. Mones, Kerrobert, Saskatchewan, Canada. App. filed April 11, 1921. Easily attached or detached.

1,462,620. TORCH FOR USE IN ELECTRIC WELDING AND HOLDER THEREFOR; C. C. Peeler, Charleston, Wash. App. filed March 19, 1921. Holder for welding wire.

1,462,632 to 1,462,634. MEANS AND METHOD OF CONVERSION BETWEEN ALTERNATING AND DIRECT CURRENTS; G. B. Coleman, San Francisco, Cal. App. filed Dec. 11, 1919. Mechanical rectifier.

1,462,690. ELECTRICAL SWITCH; C. A. Deas, Rock Hill, S. C. App. filed Aug. 16, 1922. Pedal located near foot brake.

1,462,703. ELECTRIC WATER HEATER; W. S. Jones, Orwood, Cal. App. filed Sept. 13, 1921. Instantaneous heater attachable to faucet.

1,462,719. MEASURED-SERVICE TELEPHONE SYSTEM; W. W. Owen, Oak Park, Ill. App. filed June 14, 1919. Means for automatically controlling coin-collecting device.

1,462,770. SLIDE TROLLEY; P. Schultz, Des Moines, Iowa. App. filed April 17, 1922. May be reversed, thereby increasing life.

1,462,791. AUTOMOBILE LIGHT DIMMER SWITCH; A. D. Gaston, Austin, Tex. App. filed April 30, 1923.

1,462,795. ELECTRIC BATTERY; W. R. Loveman, Bridgeport, Conn. App. filed Jan. 5, 1921. Bag-type batteries.

1,462,819. AUTOMATIC TELEPHONE SYSTEM; W. T. Powell, Rochester, N. Y. App. filed Aug. 31, 1920. Circuits of non-numerical switches employed in automatic systems.

1,462,882. RECEIVING SYSTEM; H. Chireix, Paris, France. App. filed March 24, 1922. Relay for automatic calling arrangements in wireless telegraphy or telephony.

1,462,918. AUTOMOBILE BRAKE; C. E. Norton, Loveland, Col. App. filed Jan. 23, 1922. Electrically controlled brake.

1,462,973. ENGINE STARTER; W. L. McGrath, Elmira, N. Y. App. filed Oct. 1, 1919. Relates to engaging unit between motor and engine.

1,462,987. PROCESS FOR PRODUCING NITRIC ACID BY MEANS OF THE ELECTRIC ARC; W. Siebert, Laufenburg, Aargau, Switzerland. App. filed May 13, 1922.

1,463,004. ELECTRICAL RECORDING INSTRUMENT; F. H. Bowman, Lynn, Mass. App. filed Dec. 22, 1920. Damping vane for graphic meters.

1,463,005. HEATING UNIT; W. H. Dalton, Salem, Mass. App. filed Nov. 1, 1921. In form of elongated cylinder.

1,463,017. DYNAMO-ELECTRIC MACHINE ADAPTED FOR SYNCHRONOUS WORKING; L. J. Hunt, London, England. App. filed April 19, 1921. Means whereby machine can be run as synchronous machine at speeds other than cascade speed.